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NURSE HOUND.

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Fishes

A

HISTORY

OF THE

FISHES

OF THE

BRITISH ISLANDS.

BY JONATHAN COUCH, F.L.S.

VOL. I.

CONTAINING FIFTY-SEVEN COLOURED PLATES,

FROM DRAWINGS BY THE AUTHOR.

The works of the LORD are great, sought out of all them that have pleasure therein.—PSALM cxi, v. 2.

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PREFACE.

In the work on British Fishes now presented to the public, it has been the endeavour of the Author to give such a representation of each of the species which has at any time been met with in the British Islands, either as straggling visitors or more permanent residents, as shall render it easy to be recognised by any one; as also to assign it its proper place in a scientific arrangement; and of these recorded in our volumes it is to be observed that there are several which are now for the first time noticed as having been obtained in Britain.

A coloured likeness is for the most part necessary for this purpose; and those which are now presented to the notice of the reader, with very few exceptions, that are particularly pointed out, possess the advantage of having been derived from examples that had been but newly drawn from their native element, with their native colours fresh upon them; while those species which from their rarity could not be procured under such circumstances, are produced in such a manner as not to be disguised by imaginary adorning. The descriptions also have been carefully attended to, and with the plates will leave little to be desired in illustration of this portion of the subject.

But beyond this it has been deemed of special importance to give, with as much precision as possible, an account of the characteristic habits of each species; a large portion of the particulars of which is derived from attentive observation under favourable circumstances through a considerable extent of time; coupled also with frequent communications from practical fishermen of great intelligence; who have always been ready to acknowledge small obligations by a free communication of facts in their experience.

And in addition to these matters an object has been kept in view, which the Author has deemed of high importance, although it has not usually found a place in works on Natural History; and it is to him a matter of regret that it has not been worked out to such extent as the subject demands. He has laboured, however, by repeated examination of the organs and internal structure of the several species and orders or classes of fishes to trace the connection of their several parts with their instincts and modes of life; and in all these researches, of which particulars are scattered through the work, he has been able to discern such a connection and reciprocal dependance as to establish the conviction of a presiding mind that has formed and set in action the whole; so that the inhabitants of the water are not less furnished than those of the land with the means of existence, and with faculties which enable them to turn what may appear to be unfavourable circumstances to good account. Linnæus inquires

Quis, nisi vidissit, pisces habitare sub undascrede-ret?

And his proper answer is—

Quam sapienter ea fecisti! O, Jehovah!

It is with much pleasure the Author acknowledges his obligations to gentlemen in different and remote parts of the United Kingdom, and even beyond them, for the assistance they have rendered him in the course of the work now introduced to the British public; and to several of these his thanks are the more especially due as their communications, whether of examples or information, have been altogether unsolicited. From the remotest parts of the Shetland Islands, and from Scilly, with the north and middle portions of Ireland, Scotland, and Wales, contributions have been received; a large proportion of which at least can only be ascribed to a love of science, but of which the particulars are not now given, as it was thought more satisfactory to refer to each in those parts of our work where the particular subject has been under consideration.

Of his readers then, for the present, the Author takes his leave in the words of the ancient Roman dramatists—"Vos valete;" and if their approbation has been obtained—"et plaudite!"

FISHES OF THE BRITISH ISLANDS.

Our ancestors were accustomed to call by the name of fish all the creatures which inhabit the waters; and in so doing they comprised under this term all the races of crabs and lobsters, and also many species of shell-fish, as oysters and cockles. It was even a disputed point among them whether the otter should not come under this denomination; to which this animal must be admitted to have as good a right as the bat to be classed among birds; among which, simply on account of its powers of flying, it continued to hold a place to even a modern date. But a better knowledge of nature has corrected these mistakes, and we limit our subject to creatures pointed out by the following characters. Not only, therefore, do we say with Dr. Monro, in his work on the structure and physiology of fishes, that by this name we understand that class of animals which lives in water, swims by the assistance of fins, and has the water directly applied to the gills, through which organ the whole mass of blood in the body passes in the course of circulation: which definition is so far deficient, that it would not exclude the young condition of the several kinds of frogs and newts:—but we add also, that they are furnished with nostrils, usually double on each side, which do not communicate with the mouth or that passage by which they receive the water which passes through the gills. In a fish also the whole mass of blood passes through the gills for the purpose of receiving the influence of air contained in the water, without being again returned to the heart until it has been carried to the other parts of the body. This last observation is probably referred to by Monro, but is not fully expressed by him, and in these particulars all fishes agree; but there are other characters among them which are sufficiently distinct in different families as to render it necessary for us to divide them into classes; of which, for reasons presently to be assigned, we shall place the Sharks and Rays at the head: in doing which we are not singular. The illustrious naturalists, Owen and Agassiz, have done the same; and Linnæus, whose

system of nature, although professedly artificial, was intimately connected with a profound knowledge of the affinities of natural objects, has even gone so far as to separate them essentially from the great family of true fishes, by making them a branch of his class of amphibious animals, under the title of swimming amphibians: the serpents and other reptiles being formed into another class of the same general order.

CHONDROPTERYGIOUS FISHES.

Having a skeleton with few bony particles in its structure, and also termed *Plagiostomi* from the situation of the mouth, and it may be added, the nostrils, which are beneath a projecting snout.

SHARKS AND RAY-FISHES.

As regards their proper station in the natural classification of animals we so far agree with the distinguished Swedish naturalist Linnæus, as to place the family which comprises the Sharks and Rays in the rank which is next below that of reptiles; to which order they are most nearly related in their general structure, vital physiology, and mental instincts; and not in the much inferior station which includes the Lampreys, as is done in the great part of modern arrangements.

With the Lampreys, myxine and lancelet, this class of fishes possesses nothing in common, except a soft skeleton that for the most part is without bony fibres, and several openings through which the water passes in the action of breathing; which are agreements too slight and obscure to warrant the conclusion that these families possess any near connection of natural affinity; whereas the differences in other respects, and even in the particulars named, are very wide, as we shall presently see. And therefore, while we suffer the last-named family—of *Petromyzonidæ*, or Lampreys, to remain at the end of our list, as at the vanishing point of fishes in their transition towards the class of worms, we assert for this tribe of chondropterygious fishes a prominent station at the head of the whole family of fishes.

It is because of the softness of the skeleton in the class of chondropterygious fishes that the minds of naturalists have been

impressed with the idea that the structure of the whole of them is greatly inferior as compared with the more firm and intricate structure of those which are termed bony fishes. We adopt the energetic language of Mr. Owen on this subject, and remark: "We should lose some most valuable fruits of anatomical study were we to limit the application of its facts to the elucidation of the unity of the vertebrate type of organization, or if we were to rest satisfied with the detection of the analogies between the embryos of higher and the adults of lower species in the scale of being. We must go further and in a different direction to gain a view of the beautiful physiological principle of the relation of each adaptation to its appropriate function, and if we would avoid the danger of attributing to inadequate hypothetical secondary causes the manifestations of design, of supreme wisdom and beneficence, which the various forms of the animal creation offer to our contemplation. To revert then to the skeleton of fishes with a view to the teleological application of the facts—or that which regards them as means directed to an end—determined by the study of this complex modification of the animal framework. No doubt there is analogy between the cartilaginous state of the endo-skeleton of Cuvier's chondropterygians, and that of the same part in the embryos of the air-breathing vertebrates; but why the gristly skeleton should be, as it commonly has been pronounced to be, absolutely inferior to the bony one is not so obvious. I know not why a flexible vascular animal substance should be supposed to be raised in the histological scale because it has become impregnated by the abundant intussusception of earthy salts."

"The predaceous Sharks are the most active and vigorous of fishes; like the birds of prey they soar, as it were, in the upper regions of their atmosphere, and without any aid from a modified respiratory apparatus, devoid of an air-bladder, they habitually maintain themselves near the surface of the sea by the actions of their large and muscular fins. The gristly skeleton is in prospective harmony with this mode and sphere of life, and we find well-marked modifications of the digestive and other systems of the Shark by which the body is rendered as light, and the space which encroaches on the muscular system as small, as might be compatible with those actions. Besides, lightness, toughness, and elasticity are the qualities of the

skeleton most essential to the Shark: to yield to the contraction of the lateral inflectors and aid in the recoil are the functions which the spine is mainly required to fulfil in the act of locomotion, and to which its alternating elastic balls of fluid, and semi-ossified biconcave vertebræ so admirably adapt it. To have had their entire skeleton consolidated and loaded with earthy matter, would have been an incumbrance altogether at variance with the offices which the Sharks are appointed to fulfil in the economy of the great deep.

Yet there are some who would shut out, by easily comprehended but quite gratuitous systems of progressive transmutation and self-creative forces, the soul-expanding appreciations of the final purposes of the fecund varieties of the animal structures by which we are drawn nearer to the Great First Cause. They see nothing more in this modification of the skeleton, which is so beautifully adapted to the exigencies of the highest organized of fishes, than a foreshadowing of the cartilaginous condition of the reptilian embryo in an enormous tadpole, arrested at an incomplete stage of typical development. But they have been deceived by the common name given to the plagiostomous fishes: the animal basis of the Shark's skeleton is not cartilage; it is not that consolidated jelly which forms the basis of the bones of higher vertebrates: it has more resemblance to mucus; it requires a thousand times its weight of boiling water for its solution, and is neither precipitated by infusion of galls, nor yields any gelatine upon evaporation." (Lecture 6, Hunterian Lectures, vol. ii.) The bony frame of the Lampreys, on the other hand, is little other than well-coagulated jelly, with no more than about one and a half of earthy salts in its composition.

Nor is it by the general likeness of shape, or internal structure and physiology alone, that animals should have their relative situation assigned to them in the order of nature. Separately from these there are analogies also; and although these analogies are chiefly judged of by the living actions of the races or individual species—which actions, in the view of systematic writers, whose business is principally with the dead animal, are of all foundations of classification the least definite and trustworthy—yet in their general bearing they serve important purposes in one principal aim in the study of nature. In a work intended to aid in the instruction of the public mind they should not be

lost sight of; and indeed they are in many respects scarcely less insisted on by naturalists of our own day, although unconsciously, than they were by writers of an older date; who were disposed to make them exclusively the foundation of their arrangements.

There is no reason why the lion should occupy the elevated place he does in popular estimation as the king of beasts, except with reference to his power over the weaker inhabitants of the wilderness. It is his united strength and courage which establish his rank in the estimation of writers whose labours have been directed to the history of the habits of the animal creation. We grant indeed, that in the opinion of the moralist and philosopher, the possession of mere strength and commanding—perhaps ferocious, powers and dispositions, should not be estimated as the sufficient mark to which the supreme rank ought to be assigned. But the human mind has shewn a disposition to regard these qualities as such a mark; and as a beginning even in this kind of superiority must be somewhere, and the consent of ages has ascribed it among beasts to the lion, and with the same conviction or feeling, among birds to the eagle; we are only proceeding in the same direction when we view the Sharks as holding the same relative rank among the families of the ocean. They live by the exertion of similar powers with those of their analogies of the land and air, and even in general with more insatiable appetites and energies.

But there are other circumstances involved in the structure of this class of fishes which are worthy of our notice, as tending to shew the station they hold among their fellow natives of the deep.

The skin of Sharks bears a nearer resemblance in toughness and strength to the covering of the higher order of animals, than to the other classes of fishes, and even than does that of their kindred chondropterygians or plagiostomes—the Rays; the latter of which orders has this covering for the most part soft and moist, although in several of the genera it is studded with tubercles; but instead of scales the skin is closely covered and defended with spines, which in substance bear a not very distant likeness to horn, and are even more firm and compact. Beneath the skin is a layer of fibres which have the strength and appearance of tendons, which cross each other in opposite directions

at acute angles. The muscles themselves have a resemblance to those of quadrupeds, and the bundles of fibres which constitute their substance appear to possess the powers of separate action, by which the motions of the fish may be more minutely and effectually regulated. Such muscles as lie behind the ventral fins are accompanied with what may be denominated tendons, which are a portion of animal structure that does not exist in the common class of bony fishes; and by the use of these, which are longer and stouter the nearer they approach the tail, that important organ is enabled to put forth its very powerful action without being itself inconveniently stout. Although the lateral muscles of a fish's body may be said to be innumerable, there is some propriety in considering those of the body of a Shark as forming four of large size, over and above those which are smaller and subordinate; for the tendino-cellular membrane interposed between the skin and muscle passes between those larger masses of muscle, and may be said either to divide or unite them, and at the same time serving to give firmness to their action by the general support it affords them. This description is more especially taken from the Ray-mouthed Dogfish and Toper (*Mustelus lævis* and *Galeus vulgaris*;) but with some variation it is, doubtless, observable in all Sharks. But it is more distinctly marked in the former species than in the latter, thus directing our views to its importance; and accordingly it has been observed by fishermen that the former fish, when it has taken the hook, is much stronger in the water than the latter.

It is on account of the particular structure of the muscular layers in Sharks that they are able to direct their motions with greater precision than the generality of fishes, and also that they can continue their efforts without weariness for an almost unlimited duration of time; and accordingly sailors inform us of the vast extent of ocean along which they have been accompanied by some of those fishes, without apparent weariness, when their appetites or expectations have been excited after prey.

We shall defer the description of the eye of the Rays until we come to speak particularly of that tribe of fishes; but this organ is but little less curious in the Sharks, although its structure is founded on very simple principles as compared with that of other animals. In most kinds of fishes the eyes are round and prominent, without the possibility of being closed, even in sleep

or at the approach of danger; but in the generality of Sharks, if not in all, the exposed surface becomes oval by means of a structure of the skin above and below the globe, which, when the fish finds itself hooked on the line, or otherwise in danger, is made to close over it, somewhat after the manner of the eyelids in birds. The globe itself is supplied with muscles to direct its actions, and its sphere of motion is still more extended by means of a contrivance, in which we see a remarkable instance of the skill by which what might appear to be a new organ, is produced by the simple lengthening out of a well-known part into a new form and for a new but important use. On examining the cavity in which the eye of the Shark revolves, we find that the globe, which is the immediate seat of the power of vision, is lifted from the bottom, on which, in other animals besides those of this great family, it rolls, and is placed on a small table that itself forms the top of a slender pillar, the bottom of which is fixed on the bony circle of the common ocular cavity; or more properly speaking the pillar itself, which leans a little forward that it may be accommodated to the most usual direction in which objects are viewed, is an extension or modification of the orbitary process of what anatomists term the sphenoid bone. The height of this ocular pillar has the additional advantage of allowing a greater length to the muscles which move the eye, and by so doing, of providing for a more sudden, as well as a more extensive action of the eyes in prowling for their prey.

The remarkable nature and arrangement of the teeth in Sharks and Rays has long attracted the attention of naturalists, and great have been the mistakes which have been committed in describing them and the process by which they are produced, and also the succession of them continued. In other orders of fish they take their rise from a membrane which clothes the jaws:—for we exclude the consideration of those which are found in the gullet, tongue, and palate—and they rise immediately from this foundation in an upright direction. Here they remain attached for a time, and then they fall away, at uncertain intervals, to be succeeded by others. With the Sharks and Rays it is widely different; and the particulars of the process by which they are produced have been first and most extensively described by Mr. Owen; but they had to some extent been observed by myself, before I had obtained an opportunity of learning them from that gentleman's more extensive discoveries.

In all fishes the first step in the formation of teeth is the simple production of a soft vascular papilla, or pimple from the free surface of the membrane of the jaw near the mouth; but in the Sharks and Rays these papillæ do not proceed to sink into the substance of the gum, but become covered by caps of an opposite free fold of this membrane. These caps do not contract any organic connection with the papilliform matrix (and in the torpedo they are very loose,) but as this is converted into dental tissue the tooth is gradually withdrawn (the points of the teeth at first lying flat downward, or in the direction toward the mouth,) from the extraneous protecting cap, and as they become hard from being covered with an enamelled surface, they assume the upright posture on the border of the jaw. It has been assumed that the number of rows of these teeth are marks of the age of the Shark, and that an additional row is added for each year of its growth. But this is no further correct than as the greater breadth of the jaw from the greater size of the fish produced by longer life, affords a wider space for the teeth to stand upright. A Shark of nearly full growth, if young, may have no greater number of rows of teeth standing erect than a couple, but there are several others at the same time in the act of production; and they are carried forward on the surface by an action in the membrane itself on which they rest, until, being commonly broken or worn down by the violence to which they have been exposed, by the time they have reached the outer edge of the jaw, an exfoliation of the membrane itself has taken place, and they drop off by a natural process of exfoliation, to be succeeded by others, which are in their turn formed at the border of the jaw nearest the mouth, and pass upward and outward: the whole proceeding bearing no distant likeness to that by which the nails are formed in our fingers, or hoofs in the feet of beasts, to be passed onward to the part when their use is required, and by which they are at last set free from their attachment, and lost. The production and protrusion of the teeth in the family of Rays is substantially the same as in Sharks; but the more slender bony process that in most species projects from the base, is sooner broken down by the crushing process of feeding on crustaceous or hard food; and the jaw is therefore, in most cases, rendered almost smooth before the teeth have advanced so far as to be rejected.

There is only one other subject connected with the general

history of this order of fishes, to which we will address our attention, and this is the manner in which they produce their young. The males are distinguished from the females in a way very unlike any that is seen in other families of fishes, and this is by being in possession of jointed organs that are attached to the body, close to the ventral fins; and which are usually known by the name of claspers, but of which the precise use is little understood, although we may suppose that they have some connection with the offices of love. Neither the Sharks nor Rays possess what can be termed a milt or roe, as in bony fishes; but they have something equivalent to those organs, which is found studded with eggs in various stages of growth; and as these escape from their primitive station they descend to their proper receptacle, which is divided into two chambers, where they wait for their final development. The larger number of Sharks are found to hatch their young within themselves, but without any adhesion to the organ in which they lie; and the only exception to this internal hatching, at least as it is applicable to the British genera, is found in the genus *Scyllium*, or ground Sharks, of which we will speak particularly when we describe the habits of that race. The Rays, without any exception that is known, resemble the ground Sharks, in excluding the egg before the final perfection of their young.

Of the first named, or viviparous Sharks, the eggs descend from the ovary either at once, as in several species, or in long succession, as is the case with the Picked Dogfish; and in the double receptacle into which they are now received they obtain a rather rapid development, in the progress of which they offer an interesting spectacle to a close observer, as being even more remarkable than that which takes place in the egg of a bird.

The slight membranous covering which at first enveloped in one mass the embryo fish, and the proper egg which is to supply it with sustenance during the period of its interuterine growth, has been burst asunder by extension, and the young fish lies in its receptacle awaiting the changes that shall prepare it for being launched into the waters of the ocean. But during this stage of inaction a temporary substitute is required for the purification of the blood, in place of the more perfect gills which will have to perform this function in their future con-

dition. A number of vascular fibres are provided, which hang from the orifices of the breathing holes, and even from the temporal orifices where these are provided; and they do not disappear until the creature is prepared for its permanent state of existence. It is a remarkable instance of the accuracy with which the transitory condition of interuterine existence is provided for, that the whole of the contents of the nutrient bag forming the egg has become absorbed into the body at the very instant when its presence is no longer required, and the fish has become capable of seeking for its own support.

It may be mentioned as a piece of superstition, that in no very distant times the teeth of Sharks, under the name of serpent's teeth, were set in silver, and used to render more easy the cutting of the teeth in children. It was more in reference to their supposed ocult virtue, than to their mechanic effect, that even so wise a man as the physician and naturalist Rondeletius believed that when reduced to powder they formed also an excellent tooth powder.

SHARKS.

These are fishes of a lengthened form, having the mouth and nostrils placed under a projecting snout, the jaws furnished with several rows of teeth, the gill-covers bound down to the side, and the openings like separate slits in the skin, not less than five in number. The fins covered with the common skin, the tail irregularly lobed, the upper portion being of greater length than the lower, and having the vertebræ, or joints of the back, carried onward close to the border of the caudal fin.

There are some kindred species, which vary in some degree from the shape most common in this family, by approaching more nearly to that of the Rays; on which account they are said to be aberrant. Of these we shall take notice when describing such of them as have been taken on the British coasts.

The following arrangement of such of the genera of this family as belong to the catalogue of British fishes, is derived from the "Animal Kingdom" of the Baron Cuvier, but modified in a few particulars, by the observations of the German naturalists Muller and Henlè, and by Dr. Gray.

SCYLLIUM.

Generic Characters.—The snout depressed, short, and blunt; nostrils with a channel extending to the edge of the lip; a temporal orifice behind the eye; an anal fin; the two dorsals not before the ventral fins. The generic name is from Τα Σκιλλια, the common name employed by Aristotle for these fishes,—perhaps because the prickly covering of their skin rendered them troublesome to handle.

NURSE HOUND.

BOUNCE AND CATFISH.

Squalus canicula,	Linnæus.
Catulus major,	Willoughby and Ray; p. 62, but the figure, B 4, does not convey a proper idea of the fish.
Scyllium catulus,	Fleming; British Animals, p. 165.
" *stellaris,*	Jenyns; Manual, p. 496. *(Not of* Risso, Icth., p. 31.)
" "	Yarrell; British Fishes, 2nd. ed., vol. ii., p. 493, but the figure is very imperfect as a representation.
Le Squale Roussette,	Lacepede; Ed. l'an 6 de la Republique, 12mo., vol. ii., p. 8; but he confounds together this and the Common Rough Hound. The *Squalus canicula,* No. 112, *La Roussette tigrée,* the Bounce of Bloch, has ocellated spots, and certainly is not the Nurse Hound, probably the *Squalus stellaris* of Authors.

This species and the Rough Hound, next to be mentioned, are classed as ground Sharks, because their usual station is near the bottom, where they seek their prey, mostly in rough and rocky ground. Such of them as wander on more open ground are of a lighter colour, in conformity with a law of nature in fishes, by which they assume an intensity of tint corresponding with the ground which they frequent. Their food for the most part consists of crustaceous animals, as

crabs and lobsters; but, like most others of this tribe, they are ready to seize any tempting prey that comes near them. They are therefore often taken with a line; but the capture is of little value to the fisherman, as their flesh is too rank for even the coarsest stomachs. The liver affords some oil; and the skin might be used for polishing wood, but that it is too rough to be employed on the finer sorts: I believe a species of this family from the Mediterranean is preferred for this purpose.

This fish is not commonly found near the shore; and for this cause chiefly it is most frequently met with through the summer and autumn, when fishing boats are able to venture into the deeper water of the channel, where they are to be met with. But there is reason to believe also, that at this season they change their ground; for even when the weather has permitted fishing in their summer haunts, and that too with what is known to be a favourite bait, they have not been caught until the spring is advanced.

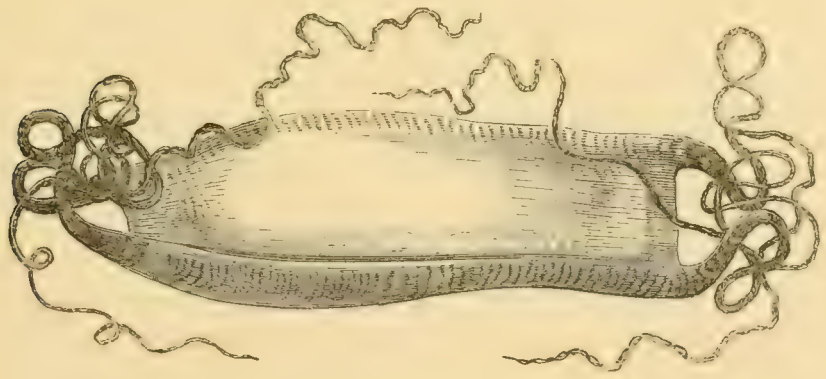
The young are not hatched within the body as is the case with the generality of Sharks; but they are separately enclosed in purses, which are of a firm texture like leather, of an oblong form, about three inches long, with a raised border, and having extended tendrils at the four corners; which become curled up when in contact with the water, and so fasten the case to some fixed substance, which preserves it from being tossed about by the violence of storms, and in some degree serves it in place of a nest. They are deposited singly, or no more than two or three together, late in the year. But although I have sometimes found these purses attached to some stalk of flexible coral, I have scarcely known an instance where the purse has been obtained from the body of the fish; from which the conclusion seems to arise, that at that time it does not take a bait. I have met with a young one, taken in a net, of less than four inches in length, but bearing all the marks of its full-grown parent.

Although not so formidable with its teeth as many other Sharks, this fish is well able to defend itself from an enemy. When seized it throws its body round the arm that holds it, and by a contractile and reversed action of its body grates over the surface of its enemy with the rugged spines of its skin, like a rasp. There are few animals that can bear so severe

an infliction, by which their surface is torn with lacerated wounds.

This species becomes more scarce as we proceed northward in the British Islands.

This fish grows to the length of four or five feet. An example, three feet nine inches long, measured thirteen inches in girth behind the pectoral fins. The head depressed, blunt, rounded in front; eyes two inches from the front, three inches asunder, their figure a narrow oval, with a longitudinal fold below each of them; temporal orifice round, below the line of the posterior angle of the eye. The body lengthened posteriorly, with the tail extended in a direct line with its length. Pectoral fins low on the body, and wide. From the snout to the anterior dorsal fin twenty-two inches, to the second dorsal two feet five inches and a half; neither of them large. Anal fin opposite to the space between the dorsals; the abdominal fins anterior to the first dorsal. Caudal fin ending square. Nostrils an inch and a half from the snout, near the margin, the lobe irregularly folded; the mouth circular, an inch and a half from the snout; teeth sharp, and in several rows. Colour dusky red, with numerous large dark spots; below white. The skin very rough from spiculæ, the points of which are directed backward.



OVUM OF NURSE HOUND.

ROUGH HOUND.

LESSER SPOTTED DOGFISH. ROWHOUND, the ancient pronunciation of Rough. MORGHI.

Squalus catulus,	LINNÆUS.
Catulus minor,	WILLOUGHBY AND RAY; Tab. B. 4.
" *aristotelis,*	JONSTON, Article 2, Punctum 2.
" "	DONOVAN'S Figures of British Fishes, No. 65.
Scyllium catulus,	FLEMING'S Br. Animals, p. 165, but this author is confused in his account of these fishes.
Squale roussette,	LACEPEDE; Poissons, vol. ii.
" "	JENYNS' Manual, p. 495.
" "	YARRELL'S British Fishes, 2nd. ed., vol. ii., p. 487.
" "	BLOCH'S Figures; *Squalus catulus,* Lesser Rough Hound, No. 114, a bad figure, probably taken, as also that of the Nurse Hound, from a badly-dried skin.

THIS species has much the same habits as the Nurse Hound, in keeping near the bottom, and prowling about in search of crustaceous animals and small fishes; but it is more frequently caught with the line, and that too at all seasons, as well as at a less depth of water. I have found it ready to shed its purses in April, but the more usual time is in summer and autumn, when it is common to find them in pairs in the body of the fish; and also eggs before their full development in considerable numbers. These purses are much smaller than those of the Nurse Hound, less firm in texture, of a different shape and a pale yellow colour; with slender tendrils at the corners, that at first may be stretched out to the length of a couple of feet. These, as in the case of the Nurse Hound, serve the purpose of mooring the egg-case to some fixed object; and to ensure its safety the fish at first passes with it

ROUGH HOUND.

round some tuft of flexible coral or sea-weed. The case thus becomes drawn from the body, and the remaining tendrils serve to bind it to the substance to which it is attached; to which, with a curling and contracting motion it becomes bound very firmly. I have seen where this action has caused the whole to assume the appearance of a nest, with the treasure well concealed within it, and of such a one the following is a particular description:—The main support of the whole mass was the flexible coral called *Gorgonia verrucosa*, about the branches of which the tendrils were entwined. The case still held the embryo, unhatched, within it; and the tendrils were so embedded and matted with the branches, as well as with the twisted threads of *Sertulariæ* growing on the same stone, as to shew that the principal portion of the *Gorgonia* (sea fern) and the whole of the *Sertulariæ* had obtained their growth since the egg-case had been deposited. There was also attached to this egg-case a pecten (shell-fish) about three lines in length, some serpulæ (*triquetræ*) and anomiæ (*ungues*,) and a considerable portion of one side of the case was covered with a thin coating of alcyonium. This was about the middle of December, and the coldness of such a season may explain the long delay which appears to have arisen in the development and escape of the embryo. But that it is not usually accomplished in a short time appears from the fact, that some egg-cases placed in pools of the rocks exposed to the free access of the sea, were not developed in several weeks, although they had made sufficient advancement to shew that it would be accomplished in due season.

There are four slits at the corners of the egg-case, which have attracted the notice of naturalists, but the use of which has not yet received a satisfactory explanation. One supposition is, that they serve to admit water to the embryo within the case; but on trial I have found that the presence of even a small quantity of sea-water at an early stage of its existence is fatal to life. Another supposition is—that they serve to allow for the growth of the embryo by providing a means of escape for any fluid that might accumulate in the vacant space, and interfere with the growth of the enclosed young. Their use is at least obscure, as I have not been able to discover any corresponding slit in the egg-case of its kindred

species, the Nurse Hound, nor in those of any of the Ray tribe.

The motion of this species in the water appears to be slow and irregular, and little under the direction of intelligence; so that the prey might seem to be sought for at random rather than in pursuit. When high in the water, whither it sometimes ascends, its progress is serpentine, with a motion of the head corresponding with that of the hinder part of the body.

Fishermen remark that when in danger, both this species and the Nurse Hound shut their eyes; which is done by lifting the lower eyelid, as is the case with birds.

The Rough Hound is in but little esteem with us as food; but it is not altogether rejected, for in the West of Cornwall it is used to make what is there valued as morghi soup: the name of morghi being an Ancient British word that signifies a sea-dog.

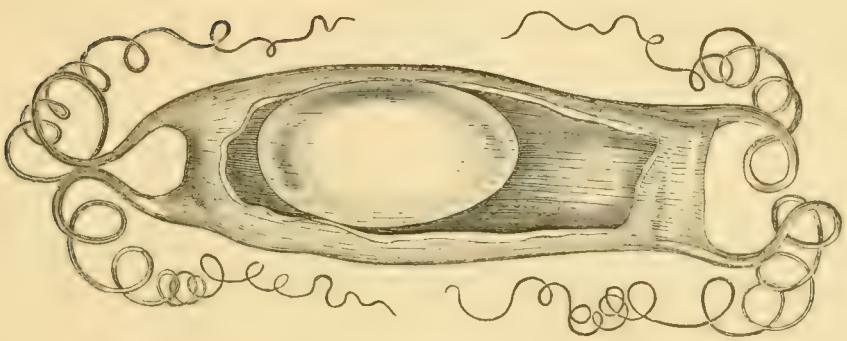
But in some foreign countries it is greatly valued. Willoughby found it for sale in the market at Rome; and Risso, who confounds the species, and supposes the *Scyllium stellaris* to be the same with the *Catulus maximus* of Willoughby and Ray, speaks favourably of it, and pronounces the liver especially to be delicious. It appears, however, that as food it is not always without danger; and Lacepede mentions an instance where a family after eating it had a narrow escape of their lives. It is scarcely necessary to caution English people against exposing themselves to the same danger.

It is a general remark, applicable indeed to the whole family of Sharks, that the female exceeds the male in size; but whether, as in their analogical races, the lion and eagle, they exceed also in ferocity, we have no opportunity of knowing. But the opinion of some naturalists—that some of the species continue to increase in bulk as long as they live, is certainly erroneous. Sharks generally are of quick growth; but they reach a definite magnitude in a very few years, and beyond this are not found to advance.

In form it is more slender than the last species; it rarely reaches a yard in length: the specimen described measured two feet six inches. Head depressed, snout short and blunt, an inch and a quarter before the eye, which latter organ is of a slender oval shape; temporal orifice near its posterior angle; nostrils

large and lobed; mouth nine tenths of an inch from the snout. Pectoral fins low and wide; teeth numerous, sharp; skin rough, with short but sharp points; colour reddish brown, lighter on the belly; covered with numerous small dark brown spots, the smallest on the back, larger on the sides and fins.

I have seen an example that was paler than usual, with faint spots, but over the whole surface were scattered irregular very black patches, as if mottled with pitch; and each patch having a border round it of a lighter colour than the ground. But I could not discover any other distinction beyond this of colour, from the common examples of the Rough Hound.



OVUM OF ROUGH HOUND, (WITH CASE.)

PRISTIURUS.

This genus differs from *Scyllium* in having a more lengthened snout, nostrils unconnected with the mouth, and by a row of larger reclining spines or scales arranged like a saw along the upper edge of the tail; which latter organ proceeds in a right line with the body, as in *Scyllium*. The generic name refers to the saw-like structure of the ridge of the tail.

BLACK-MOUTHED DOGFISH.

EYED DOGFISH.

Scyllium melanostomum,	Yarrell's Br. Fishes, vol. ii., p. 495.
Pristiurus melanostomus,	Lowe's Fishes of Madeira, T. 14.
Pristidurus melanostomus,	Gray; Catalogue Br. Mus., p. 124.

This fish is widely spread, although it was not recognised as a species—at least in Britain—before the publication of Mr. Yarrell's History of British Fishes; which contained the figure and description, a specimen of which, a larger likeness, is given in this volume. It has since been found by Mr. Lowe, in the Island of Madeira; and it now appears that it is scarcely rare in some parts of the north of our island; where, however, before the publication of an authentic likeness, it had been supposed the same with our Nurse Hound: the last-named species being therefore unknown on that coast.

The Black-mouthed or Eyed Dogfish is better known in the Mediterranean than with us. It is mentioned by Risso and Rafinesque, but without adding much to our knowledge of its habits. The latter says that the blackness of the inside of its mouth had caused it to have the name—in Italian, of Bocca d'Inferno, or hell's mouth. Its haunts appear to be near the ground, and both the examples I have met with were caught with the line. It also resembles its nearest affinities the *Scyllia,* in depositing egg-cases in which the young are hatched; but

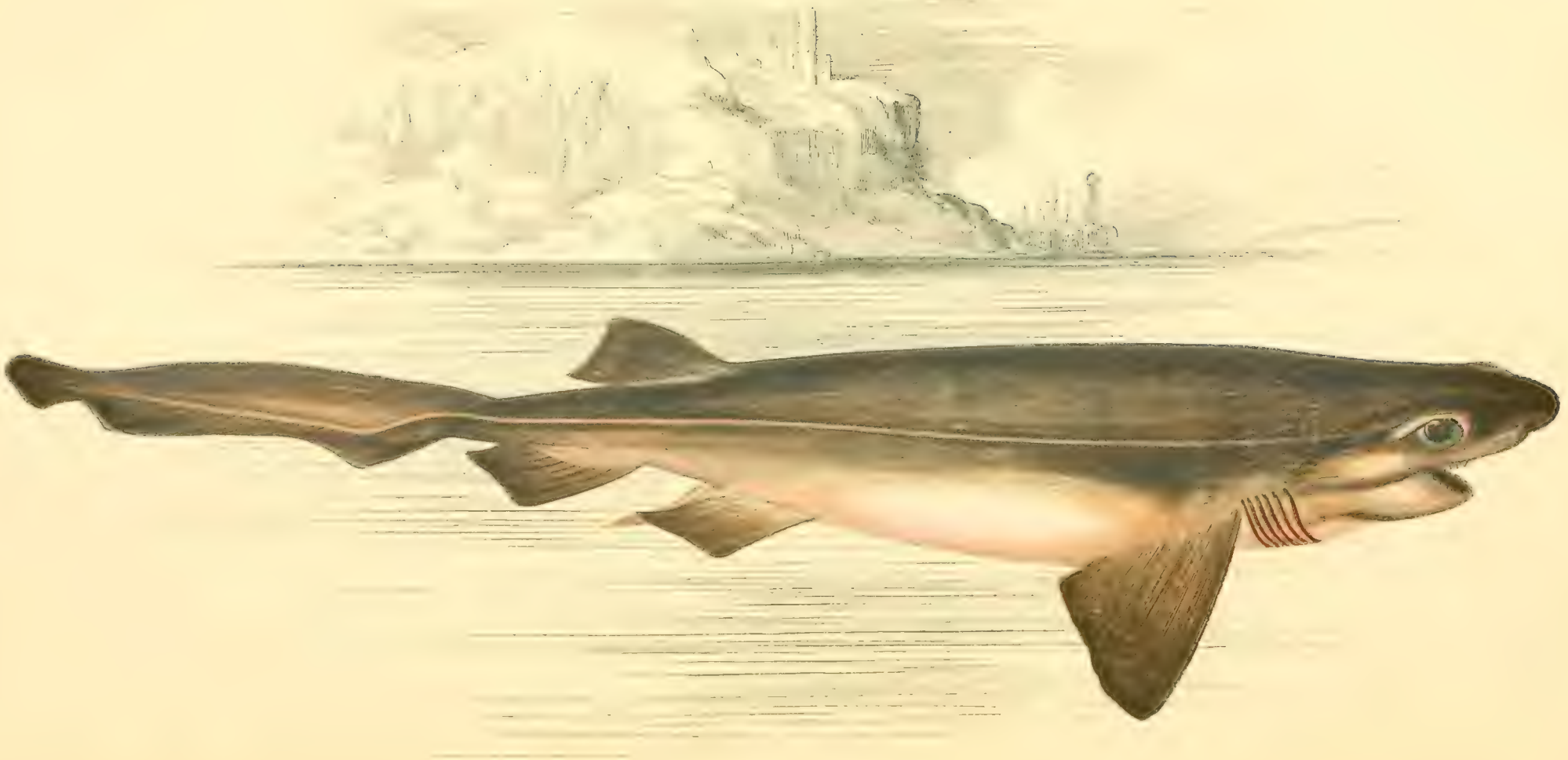
BLACK-MOUTHED DOGFISH.

the form of these cases differs considerably—as well from those of the other ground Sharks, as from the purses of the Ray tribe. Mr. Yarrell (2nd. Ed.) gives a figure of one, in which the tendrils are at one of the ends only, and so short as to be incapable of that entwining action which is the principal character of the egg-case of the Nurse and Rough Hounds. They cannot, therefore, confine it to any fixed substance, and what further use they are of is uncertain. Mr. Lowe also gives a figure of this case, but unfortunately his description is at variance with his figure; the latter being marked as of the natural size, when it falls greatly short of the specified dimensions—an inch and half long, and half an inch broad; with a smooth shining surface and deep tawny yellow brown or horn colour. It is of value, however, on one account; for there is in it a visible slit at the end where a tendril is placed, as in the purse of the Rough Hound.

The specimen, from which my original description was taken, was in length twenty-five inches and three quarters, and seven inches round where stoutest. The head flat on the top, rather wide posteriorly; snout thin, protruded one inch and three quarters from the anterior angle of the eye; nostrils one inch and a quarter from the snout, double one beneath linear, the other on the margin, the hinder edge prominent, a depression in the head immediately above it; eye rather large, oval, close behind it a moderately-sized temporal orifice; mouth one inch and three quarters wide; teeth numerous, small, sharp, at each side of the base of each tooth a small sharp process; spiracles five, open. The back a little elevated close behind the head; the skin rough when the hand is passed over it forward. Pectoral fins wide, much like those of the Picked Dog. The first dorsal begins behind the ventral fins, at twelve inches from the snout; the second at sixteen inches and a half—both rather small; ventrals ten inches from the snout; anal fin four inches long, rather narrow, terminating just opposite the end of the second dorsal; extreme length of the tail seven inches—the upper lobe in a line with the body, bent down towards the termination, round, incised or jagged; under lobe rather narrow in its course, expanded beneath; the upper ridge of the superior lobe has a double row of prickles pointing outward and downward on each side; lateral line

suddenly bent opposite the origin of the caudal fin. Colour light brown on the head and along the back; on each side two rows of ocellated spots—one row beginning at the side of the neck and continued along the side of the back; the second row commencing behind the eye and passing along the upper side of the belly, becoming obsolete near the ventral fins. These rows are separated by numerous irregular spots, which however, assume somewhat of a straight direction; the fins and hinder part of the back are finely barred and clouded with various tints of brown and yellow; the mouth dark-coloured within.

This example was a male, and was ornamented with lively colours; but since then I have obtained one in which the colour was so diluted as to appear almost of a uniform grey; although on close inspection the usual markings could be discerned. It was also a male, and its pale colour may be explained by its emaciated condition, for it appeared as if in a state of starvation. The length was a little beyond two feet, which therefore I suppose to be the ordinary size, but the caudal portion of the body behind the second dorsal fin appeared longer than in the former example.



SIX-GILLED SHARK.

NOTIDANUS.

Cuvier remarks that this genus only differs from the genus *Galeus*, presently to be described, in not having a first dorsal fin; but even a slight inspection will shew that the distinction between them is very great; and that *Notidanus* bears a closer resemblance to *Scyllium* and *Pristiurus*, as well in shape as habits, so far as the latter are known. It even appears that the resemblance is carried so far in a species found in the East Indies, that it is covered with spots, which are black. We place it therefore the next in succession to those its kindred genera; and propose to limit it more closely than Baron Cuvier has done, by excluding from it the Mediterranean species with seven gill openings. The shape and general form of the latter will warrant this; but not being an inhabitant of our seas it will not find a place in our History.

The genus *Notidanus* therefore, is distinguished by a rounded snout, the want of a first dorsal fin, a lengthened tail, which is stretched out as in the genus *Scyllium*, an anal fin, and remarkably by the presence of six gill openings. It is the genus *Hexanchus* of Rafinesque.

The name *Notidanus* appears to have been a local one among the Greeks, and may have been applied to the fish we are about to describe. It signifies "dry back," perhaps as being, metaphorically, void of a fin in the usual place.

Jonston supposes that the term *Notidanus* may have been applied to quite another species—the *Centrinè*, a native of the Mediterranean, but not found with us.

SIX-GILLED SHARK.

SIX-BRANCHIAL SHARK. GREY SHARK.

Squalus griseus,	Turton's Linnæus.
Le Squale Griset,	Lacepede. Risso; Ichthyologie, p. 37.
Grey Shark,	Zoologist, 1846, p. 1337.
Hexanchus griseus,	Dr. Gray; Catalogue Br. Mus., p. 67.
" "	Yarrell's Br. F., 2nd. Suppl., p. 25.
Notidanus griseus,	Cuvier.

The example from which the description is taken, measured in length no more than two feet two inches and half; but it has been caught of the length of eleven or twelve feet. The

head wide and level over the summit, the breadth from eye to eye two inches and three quarters; the snout rounded in front and somewhat thick; eye large, staring, and slightly oval, without an angle on the anterior portion or inner canthus, and destitute of a nictitant membrane (a loose membrane, separate from the eyelids, and which covers a portion of the globe in some Sharks. It is a conspicuous organ in birds.) This portion of the eye is immediately over the symphysis of the lower jaw. The larger nostril is half way between the eye and snout, enclosed by a prominent margin, the orifice directed forward. Temporal orifice small, an inch and half from the posterior angle of the eye. The gape large, tongue bound down and not apparent; teeth in the upper jaw eight on each side, thin at the base, the points slender and sharp, not serrated, their direction towards the angle of the mouth. A small vacancy at the symphysis of this jaw, and a little in advance of this are four teeth, the two middle ones being parallel and very slender, the points directed towards the mouth; the other two more remote, and their points diverging. A little in advance of these are other two, which might easily escape observation, being slender, smaller, and more loosely attached. As in the upper jaw so in the lower there is a single row of teeth, but they differ greatly in form, being thin and broad, their anterior margin higher, the sloping edge finely serrated; they are six in number on each side of the symphysis, with what appears like a small bifid intermediate one. Orifices of the gills six, closely approaching each other; the openings long and encircling the throat. Pectoral fins wide, triangular. Body with the general proportions of the Picked Dogfish, but the head wider and larger. Dorsal fin single, its anterior edge fourteen inches from the snout, and opposite the space between the ventrals and anal—larger than the latter. Caudal fin six inches and a half long, and consequently more than one fourth of the length of the fish; and longer as well as more slender than that of any other British Shark except the Thrasher,—*(Alopias vulpes.)* The lower lobe of this fin is falcate, and grows more slender as it proceeds, being narrowest opposite the notch. Along the posterior two thirds of the upper margin of the tail is a row of spines, of three series, closely pressed together at the roots, and the two outmost regularly diverging,

thus shewing a near correspondence with a like structure in the genus *Pristiurus*. The texture of the skin is rough when felt against the grain. Colour blackish brown on the back, and pectoral, dorsal, and caudal fins; reddish grey on the sides, white beneath. Lateral line pale, bent suddenly down at the falcate portion of the tail. Conjunctiva of the eye bluish white, the pupil large and black. It was a male—the claspers small.

The example here described was taken with a line, at the distance of about three miles from the land on the south coast of Cornwall, and at the time when it was caught appeared to be feeding on pilchards. In its habits it is undoubtedly a ground Shark, and like the others of that class—the Nurse and Rough Hounds—appears to want activity. The fisherman who caught this fish informed me that it scarcely moved after it was taken into the boat. Risso says that in the Mediterranean it keeps in very deep water, but in some parts is not uncommon; but Swainson never met with it during six years in which he resided in Sicily. It also appears to have been unknown to the older naturalists, and I have sought for it in vain in the works of Rondeletius, Gesner, Willoughby and Ray, Jonston and Ruysch, who may be judged to represent the ichthyological knowledge of their day. It was not known to Artedi, nor to Linnæus so lately as at the publication of the tenth edition of his system; but is recognised in Turton's translation of Gmelin's edition of that work, under the scarcely appropriate name of *Squalus griseus*. It is there represented as growing to the length of two feet and a half; but although this differs so little from the size of the Cornish specimen, it is clear, from the additional teeth specified by Turton, that the latter must have been a younger individual. An example, the first and only other that has been taken in Britain, was caught with a line off Ventnor, in the Isle of Wight, and measured little less than eleven feet in length; and Risso describes the fish in terms which can signify nothing less than these full proportions. In the specimen referred to by Turton there was only one row of teeth in the upper jaw, but there were many rows in the lower; from which we may judge that it is about this period of its growth that the evolution of dentition begins to shew itself, and first in the lower jaw. Risso assigns three rows of triangular sharp-pointed teeth to the

upper jaw, and to the lower five; and he adds that the central inferior teeth are sharp and conical; by which I understand him to say, that at the symphysis, between the lateral arrangements of flat serrated teeth he made out two or more of what I had supposed to be a single bifid tooth. It is probable he is correct; but they are pressed closely together, and erect, so that their exact structure cannot be ascertained without some degree of mutilation.

Both the British specimens here referred to are now added to the stores of the British Museum.

HEAD OF SIX-GILLED SHARK.

WHITE SHARK

V

CARCHARIAS.

The species have no spiracles or breathing orifices behind the eyes, and have an anal fin. The first dorsal fin much before the ventrals, and the second about opposite to the anal. A depression at the origin of the upper lobe of the tail. The teeth are generally compressed and cutting; usually serrated on the edge; but this can scarcely be taken into the definition of the genus, since one or two species are without it, that in all other respects agree with the others.

Carcharias is the Greek name of some kind of the larger Sharks.

WHITE SHARK.

Squalus carcharias,	Linnæus and Cuvier.
Canis carcharias,	Lamia and Tiburo of Authors; Artedi.
" "	Jonston; Articulus 2, Punctum 1.
" "	Willoughby; p. 47. Cuvier rightly observes that Willoughby's figure, B 7, is not worthy of being referred to. This was copied among other "ill-shaped fishes," from Gesner, who probably had possessed a dried skin of the fish; and from him again it was copied by Jonston. But Cuvier has overlooked a figure in the appendix, tab. 5, f. 1, which Willoughby had copied from that accurate Dutch traveller, John Nieuhofs; and which, except at the end of the tail, affords a very tolerable figure of the species we have to describe.—*Risso; Icthyologie,* p. 25.

That more than one, or even two species, have been confounded together under the name of the White Shark, is almost certain. It seems remarkable also that no trustworthy figure and description are to be found, of a species which is seen in abundance in the West Indies; where it is the dread of sailors, who are in constant fear of becoming its prey when they bathe or fall into the sea. That it sometimes wanders into the British Channel there is much evidence to shew. In

the "Annual Register," for 1785, quoted in "Loudon's Magazine of Natural History," vol. vii, it is said that in September of that year, vast numbers of the West India Shark appeared in the Channel, and many of them were taken by fishermen of Brighton. The example presently to be described, and of which we give a figure, was of small size, and measured no more than fifty-four inches in length; but several others have been seen in Mount's Bay in Cornwall, of much larger size; and one, which was seen by a gentleman who had often observed the White Shark in the West Indies, and was pronounced by him to be of the same species, measured about twenty feet in length

It appears necessary to make those remarks on the identity of the species, since the Great White Shark of the West Indies is said not to be furnished with a spiracle behind the eye; whereas in the description of our example it will be perceived that this organ existed, although it was of such small size as to be easily overlooked. This circumstance would transfer the species to the next following genus *Galeus;* of which no other British species is known beside the common Toper. But I prefer to let it remain in this place, at least until it is ascertained whether or not there is another species without a minute spiracle; and consequently whether or not naturalists are in error in that respect.

Laid by the side of a Toper of the same length the difference was conspicuous, even at first sight, although the likeness was sufficiently near to bear a comparison. A well-marked distinction is in the eye, which stands out prominently, exceeding that of the Blue Shark in this respect, while in the Toper it is slightly below the level. The spiracle is very small, and barely on a level with the surface, where in the Toper there is a depression. The snout of the latter fish has the appearance of being longer, through the great thickness of the head, and prominency of the eye of our White Shark; the snout of which is also substantially thicker, and consequently less flat. It is especially sunk in at the nostrils, where the Toper is much less so, and its nostrils are less open. Teeth notched on both edges; pectoral fins longer; the body thicker throughout, especially from the abdominal fins to the tail. From the second dorsal to the tail, where the Toper is round, there is a cavity

or depression; anal fin a little less than the second dorsal. Colour brown, darker on the back, lighter on the belly.

It should be observed that the tail of the White Shark, as represented in Mr. Yarrell's figure, 2nd. Ed., vol. ii, p. 502, does not agree with a specimen of that part in my possession from the West Indies, nor indeed with the other figure at page 503, nor with Lacepede's plate 8, fig. 1 of vol. i.

The White Shark is to sailors the most formidable of all the inhabitants of the ocean; for in none besides are the powers of inflicting injury so equally combined with eagerness to accomplish it. They usually cut asunder any object of considerable size, and thus swallow it; but if they find a difficulty in doing this, there is no hesitation in passing into the stomach even what is of enormous bulk; and the formation of the jaws and throat render this a matter of but little difficulty. Ruysch says that the whole body of a man, and even a man in armour, (loricatus,) has been found in the stomach of a White Shark; and Captain King, in his survey of Australia, says he had caught one which could have swallowed a man with the greatest ease. Blumenbach says a whole horse has been found in it; and Captain Basil Hall reports the taking of one in which, besides other things, he found the whole skin of a buffalo, which a short time before had been thrown overboard from his ship. Happily the visits of this fish to our coasts are too rare to expose our sailors to its depredations.

Upper and under tooth of White Shark, from the West Indies.

BLUE SHARK.

Squalus glaucus,	Linnæus.
" "	Gray; Catalogue of British Museum, p. 125.
Carcharias glaucus,	Cuvier.
" "	Fleming; British Animals, p. 167.
" "	Jenyns; Manual, p. 499.
" "	Yarrell; British Fishes, 2nd. Ed., vol. ii, p. 498.

The Blue Shark is a restless and wandering fish, which migrates to our coasts in summer, and is even found at that time to stray so far north as the Orkney Islands; but it leaves us again on the approach of winter; and if, with the commentators on the Halieuticon of the poet Oppian, we are to believe that the fish Glaucus of that writer is the same with the Glaucus of Ælian, the season when it abounds with us is the time when it has disappeared from the seas of Italy. I have known it thrown on shore in Cornwall so early as the first week in March, but it is rarely seen before the month of June; when its arrival is made known by the injuries it inflicts on the nets and lines of fishermen. This is done in hunting after the fish that have become entangled, and so are more easily seized; and as the drift-nets are stretched out for pilchards or herrings, it will pass along their course from one end to the other, and cut out every separate fish with the portion of net that held it; all of which it swallows together. If it is entangled for a moment, its keen and serrated teeth soon effect an escape, whether from the net or hook; but the latter case is sometimes attended with difficulty, and then it is that its instinctive efforts often lead to a curious complication of circumstances.

It is the habit of such of the family of Sharks as swim high in the water, when they seize their prey to do it with the action of turning the head and fore parts of the body; which method

BLUE SHARK

of proceeding has been supposed to arise from a difficulty that is felt in seizing an object with the mouth in a prone position; but which appears to be adopted only that they may obtain a greater advantage in a rolling motion, to cut the object in two parts, or more effectually with a vibrating action of the head, to separate such a portion as they are prepared to swallow. On a large substance, with their formidable array of teeth the grasp cannot fail to be successful; but with so slender a bulk as a fisherman's line, it is sometimes otherwise; and when this has escaped the grinding action of the bite, the turning of the body is continued until the whole of the line is twisted round itself, and the fish is thus brought to the surface, even from a depth of forty fathoms.

The Toper has been known to do the same thing under the like circumstances.

It appears that this fish pursues its prey by sight rather than by scent, although its nerve of smelling is of large size; but it is known to be sensible to a nauseous smell or taste, for fishermen assert that it may be driven away by pouring bilge-water into the sea where it is: a piece of information that may be of use in reference to the still more destructive White Shark.

The Blue Shark seems to have a generally rapacious appetite, and has been known to leap out of the water to seize a piece of beef hanging on the quarter of a ship. It is only owing, therefore, to the circumstance that usually it does not come very close to the land, or enter harbours, that man himself does not suffer from its voracity. Jonston is of opinion that it shews a preference for human flesh; and he records an instance where a soldier was attacked by it, and had a narrow escape from being severely bitten. In a fish of such indiscriminate appetite it might appear superfluous to specify particulars; but from the stomach of one of six feet in length I have taken a large Picked Dogfish and a Conger, each bitten across at the middle, and also a Grey Gurnard. In another instance there were found four mackerel, half a garfish, and as many herrings, wholly uninjured, as the fisherman sold for eighteen pence. Yet after such a hearty meal the Sharks devoured the bait.

It is also remarkably retentive of live, as indeed are the whole

of this tribe of fishes. An individual was caught with a line, its liver was cut out, and the bowels left hanging from the body, in which state it was again thrown into the sea. But it continued near the boat; and not long afterwards it pursued, and attempted to devour, a mackerel that had escaped from the net. In another instance the fish was thrown overboard after the head had been severed from the body; after which, for a couple of hours, the body continued to use the efforts of swimming in various directions—to employ the comparison of a boy on board the boat—as if it were looking for its head. When taken into the boat a large Shark may still prove a formidable enemy, by lashing with its tail in all directions; but the chopping off of this organ presently removes the danger. There is, however, another mode of proceeding, which may be more conveniently and effectually practised, even before it is lifted into the boat. The olfactory nerve, which is the largest in the body, is so stunned by a blow on the snout, that for a time the creature is entirely disabled; although indeed continued immersion in the sea will again restore the possession of its energies. A Shark of very large size, that was making great resistance, was speedily disabled by having its tail laid hold of, and lifted high out of water, while the head and upper parts remained immersed.

This species does not produce its young during the time it is on our coast, and in only one instance have I found eggs in its body. We may therefore conclude that its fecundity is between the time of its leaving our seas in the autumn, and its return in the early part of summer; but the young ones of about eighteen inches or two feet in length, frequently come to us with their parents.

In regard to this point in the history of the Blue Shark, as also of some others of this family, there are some remarkable particulars, in which the opinions of ancient writers find little favour in the judgment of modern naturalists, from the well-known credulity of the former, and their proneness to place a wrong interpretation on even the commonest occurrences of nature; but which are supported by the observations and consequent belief of sailors of our own day. Nor are the latter disposed to alter their convictions by the doubts or disbelief of the scientific naturalists of the land and closet. I refer

especially to the credit which this fish has obtained for the exercise of intense love for its offspring, which is in remarkable contrast to the ferocity it exhibits towards the other inhabitants of the deep; and for the manner in which it is supposed to have displayed it, as described in the following translation of the Greek poem by Oppian, on fish and fishing:—

"Others, when aught disturbs the ravaged seas,
And trembling young their conscious fears express,
Extend their jaws, and shew the safer way:—
The frighted stragglers soon the call obey,
Within the concave roof uninjured rest,
Safe as the chirper in his mossy nest.
Thus the Blue Sharks, secure from chasing foes,
Within their widen'd mouths their young enclose.
Beneath the circling arch they fearless hide,
Tho' bulky forms drive on the rising tide.—
Of all oviparous kinds that throng the seas,
The fond Blue Sharks in tender care surpass.—
They near their fondlings, like some careful nurse,
Observe their motions and restrain their course,
Eye every wave, and shew the doubtful way,
Teach where to hunt, and where to find their prey.
When big with secret guilt the waters heave,
They in their mouths their shelter'd young receive.
But when the waves at their own leisure roll,
And no fierce robber drives the scatter'd shoal,
Again the parent's pointed jaws compress'd
By force expel them from their pleasing rest."

OPPIAN, Hal., b. i.

A method of taking this or a kindred species is thus described:

"When fishers meet the Shark's rapacious young,
Loos'd from its oar the tatter'd rope is flung
Unarm'd below; th' imprudent wanton flies
With eager jaws, and grasps the worthless prize.
Hooks ev'n the prey supplies; with numerous chains
His teeth recurve the entangled flax retains.
Easy the fisher's toil; the slave self-bound,
Mounts on the barbed spears retentive wound."

B. 5.

Another Greek writer, Ælian, who wrote about the same time with Oppian, but who cannot be regarded in any other light than as an industrious and indiscriminate collector of fragments which floated on the surface of society, repeats in humble prose the same opinions regarding their affection for their young; but he ascribes this affection to the father, and extends it also to the Galeus, which is one that he supposes to keep generally

at the bottom of the sea. The mistake of supposing that this fish produces its young from eggs, is common to both those authors; but the supposition countenanced by the latter, that the Galeus produces its young at the mouth, may be regarded as no other than an ignorant surmise, by an observer who might suppose that what he saw of the return of young ones from their hiding place, was really their first appearance in the world of waters.

But it must be admitted that hitherto on this subject we may justly be suspected to have been wandering in the region of fable; and that facts mentioned by those ancient authors are so often mingled with false conclusions, superstition, and errors, as to render it difficult to separate one from the other. We allege, on the other hand however, that, even when this is allowed, the information thus conveyed is so far a matter of interest as, according to information afforded us by a commentator on Oppian, the opinion of its certainty is several times referred to by some of the fathers of the church; and thus is metaphorically employed towards spiritual uses.

But incredible as this strange proceeding may appear to us, it receives corroboration from the authority of Rondeletius, who was a physician of eminence, and Professor of Natural History in the College of Montpellier; and whose book on the "History of Fishes," is still held in high estimation. He speaks of the Thrasher, *(Alopecias vulpes,)* as receiving its young in this manner when in danger, as we shall shew more at large when we treat of that fish; and besides the evidence of those whom we may suppose ignorant sailors, I have received the following information from a gentleman, who was on board a ship, of which his father, a captain in the Royal Navy, was commander, in or near the tropics. A Shark had seized the hook, and was about to be hauled on board, when four young ones were seen to escape from it; and being then drawn on deck, three more of them were cut out from the stomach or mouth. Placed in a vessel of water they were kept alive for three days afterwards, and appeared to have suffered nothing from their strange confinement.

The impossibility of surviving such an imprisonment as is here supposed, has been urged in proof that even if the young have been found inclosed within the stomach, or have been

seen to enter the mouth, the circumstance is to be explained by the well-known rapacious appetite of the parent, rather than by its affection; and that it will require both a closer and longer continued observation to render the more amiable motive the undeniable one. But that the young may be received into the stomach and return without injury, appears from evidence adduced by Mr. Darwin, in his "Journal of a Voyage round the World." "I have heard," says he, "from Dr. Allen, of Forres, that he has frequently found a Diodon, floating alive and distended, in the stomach of the Shark; and that on several occasions he has known it eat its way, not only through the coats of the stomach, but through the sides of the monster, which has thus been killed." It is further known of all the Sharks, that they possess a power of throwing up from the stomach at their will anything they find indigestible; so that the natural difficulties of the case are less than they appear.

From its well-known destructive character fishermen are always eager to shorten the race of this fish; and in consequence many hundreds of them are caught in the course of a season. But the capture is of no intrinsic value, for it yields no other profit than some oil from the liver, and the body for manure.

Jonston, in common with other writers, describes this fish as having teeth with serrated edges; but Lacepede, vol. i., knows no other but a Blue Shark with teeth specially described as having edges not serrated. Risso, Icthyologie, p. 26, describes a Blue Shark with the same characters as those of Lacepede; but he also gives another species, which he rightly believes to be the true *Squalus glaucus* of Artedi, and consequently of Linnæus, having serrated teeth, but with brilliant silvery bands on the sides; and which he names *S. Rondeletii.*

Willoughby's description is of a young one, having only one row of teeth, which are serrated; but he says they are distant from each other in the jaw; which remark can only refer to their very early condition, for each succeeding row is followed by another row, to close up the vacancies of that before it; so that when in the progress of growth they become pressed together, they overlap each other and become contiguous.

I have already given in our general history of the Sharks, a short account of the manner in which the teeth of this order of fishes are formed, and finally proceed to their decay and

loss; but as there is some degree of variety in the way in which this process takes place in the different species, I will enter a little further into the description of it as I have observed it in the present one.

We have already seen that the seat of the tooth-forming process is in a thick membrane, which covers the jaws on their inner surface, and which passes over them externally. This membrane is in a condition of perpetual production, and at its origin is formed into a series of cells or doublings, in each of which the germ of a tooth may be discovered, soft and membranous, and seemingly nourished from the sides of the sac or cell itself. It lies flat along the course of the membrane that contains it, with the point directed downward in the lower jaw, and towards the roof of the mouth in the upper jaw; in such a manner as that in passing to its final destination, it has to go through the third part of a circle, in the course of which the upper doubling of the containing cell becomes torn through its substance. The enamel of these teeth has no existence at first; so that their substance is as soft and flexible as parchment; but as their growth proceeds the nourishment from the sides of the cell ceases, so that at last it is furnished only from the root; and at this stage the circulation of nutriment by the vessels appears to be from near the point, along the middle line of each tooth, along which the solid firmness they at last obtain is clearly to be discerned. The membrane within which these teeth have been formed, is itself constituted of longitudinal fibres, of some degree of firmness, with softer cellular membrane at the part in which the teeth receive their actual formation; and as in the course of nature, the former become more rigid from defect of nourishment, they contract in their substance, and thus draw the roots of the teeth nearer to the situation they are destined to occupy, but still leaving a vacancy which can only be supplied by the successive formation of teeth in alternate order; the cells of one row being opposite to the vacancies of the other, and only pressed closer, because the fibrous membrane connecting them has in time admitted of a more rigid contraction. In some species of this great family, as the Monkfish, *(Squatina angelus,)* and many of the Ray tribe, the teeth cells are arranged in regular linear succession, without the filling up of the vacancies between them;

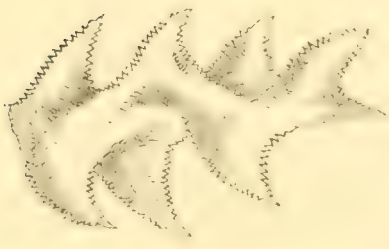
but the manner of formation and progress is otherwise the same. In the last mentioned instances, however, the teeth are short, and therefore are easily brought through the coats of the cells; but this is not the case with the Blue Shark and some others. A vacant space of softer texture in the rear of each tooth is to them of importance, as securing to them a thinner and weaker place at which they can burst through; while the contraction of the fibres of the membrane, by drawing the teeth subsequently together, secures to them even a greater firmness of support than if there had not been an original separation. But the rigidity of those contractile fibres does not stop here. Nourishment is by this means diminished, and finally ceases. The tooth becomes a dead substance, and soon falls off with the membrane itself that held it, to be presently succeeded by a new race that must pass through the same changes, and to be shed again in their turn. A limit is thus put to the number of rows the fish can be furnished with, and security taken that no old or useless teeth shall remain to encumber the jaws.

From the references given to authors who have described some kind of Blue Shark, it appears highly probable that more than one species exist, and may sometimes visit the British coasts; although I do not feel assured of being able to lay down definite marks by which they may be distinguished from each other. I must content myself for the present, therefore, in producing such evidence on the subject as shall serve to call the attention of naturalists to further inquiry, rather than run the risk of misleading them by speaking with greater certainty on their specific distinctions. On comparing two specimens a considerable difference is seen in the form of the head and eye, as well as in the tail; which in one instance runs nearly straight backward in a line with the body, while in the other this organ is wider and more elevated.

I make but little account of the variety of colour described by Risso, in his *Squalus Rondeletii*, because it is known that most fishes are liable to variation in this respect; and it is especially the case when they have changed the water and bright skies of the Mediterranean for the more sober tints of the British Channel. But the difference of the teeth is a more important distinction; more especially as I am able to affirm with confidence that this character of serrated teeth is not an

effect of age, but is to be perceived in Sharks in the earliest stage of their growth.

The largest I have heard of, but not seen, was upwards of fourteen feet long, but the more ordinary size is from six to eight feet in length; the body round and slender, tapering towards the tail. Head flat on the top, snout depressed, projecting; the mouth far beneath, well furnished with strong, flat, triangular teeth, the points inclining inward, the edges serrated. Nostrils a good distance from the mouth, and not lobed; gill openings five, near the root of the pectoral fin. Skin but slightly rough; pectoral fins large and long, although not proportionally so much so as is represented in Lacepede's figure of his smooth-toothed Blue Shark, vol. i., pl. 9, f. 1; and which therefore, if correctly represented, will be an additional mark of distinction between the two species. These fins are placed low on the body in all Sharks, and in the Blue Shark end in a point. The ventrals small; the anterior border of the first dorsal fin begins midway between the snout and root of the tail; the second dorsal opposite the anal. The upper lobe of the tail moderately long, with a notch, as in most Sharks, near the end; at its root also, where it joins the body, a deep depression, but I have known this wanting. The upper parts of the body and fins blue, the belly white.



INSIDE VIEW OF THE TEETH.

UPPER TEETH.

THRASHER.

VII

ALOPECIAS.

This is a genus established by Müller and Henlè, and described as with a pointed, conic head, very small spiracles, small gill openings, and simple triangular teeth, but particularly marked by a very great extension of the tail. It is the genus *Alopias* of Rafinesque and Swainson; but the latter writers had overlooked the very small spiracles.

THRASHER.

SEA FOX. FOX SHARK. SEA APE.

Carcharias vulpes,	Cuvier. Fleming; p. 167.
Vulpecula marina,	Jonston; p. 27.
Vulpes marina,	Willoughby; p. 54, Tab. B. 6, the figure tolerably correct, except in the tail.
Squalus vulpes,	Jenyns; p. 498.
" "	Yarrell; British Fishes, vol. 2, p. 522.
Squale Renard,	Lacepede and Risso; Ichth., p. 36.
" "	Gray; Catalogue of British Museum, p. 130.

This fish has obtained the name of Fox Shark because of its tail, which, like that of its namesake of the land, is a principal portion of its distinctive character. But the ancient Greeks and Romans, who were well acquainted with the fish, were not content with finding in it nothing more than this likeness of analogy; and therefore they went on to draw the conclusion that a fish answering to this name must of necessity be endowed with the other distinguishing portions of the foxine character.

This fish is not recognised in the tenth edition of the System of Linnæus, but it is the *Squalus vulpes* of Turton's Linnæus.

The Thrasher, or Sea Fox, is so very rarely taken on a line, that no instance of it has come within my knowledge; but the reason of this probably amounts to no more than that fishermen do not employ the bait that tempts its appetite. Ælian, how-

ever, reporting the common opinion of his day, supposes that this portion of its safety is to be ascribed to superior cunning. According to him it is so cautious of a hook, as scarcely to be enticed to come near it; or if appetite at any time should overcome caution, it would mount upward to slacken the line, and then cut away the hook before the fisherman was aware of its presence. Or if unfortunately the hook had found its way into the stomach, it would turn this organ, with its entrails also, inside out, and so get rid of it and the danger together. (Var. Hist., B. 1, C. 5, and Hist. of Animals.) Oppian also speaks of the same proceeding as an instance of superior intelligence, (B. 3,) and from him we learn that in fishing for it, at least the lower portion of the line was formed of hair. To guard the hook from being cut away, the line for some distance above it was armed, or as a fisherman who now uses the same precaution, would say, was ganged, with flexible brass wire twisted regularly and firmly around it. But strange as they may appear, these efforts to escape are not to be altogether regarded as imaginary on the part of the writers. We cannot indeed affirm it of this species in particular, but the greater part of the Sharks will deal with the fisherman's hooks in the manner described; and there are fishes, although perhaps not Sharks, which are known, probably through fear, to evert the stomach, when drawn up with the line. The explanation of the ancients is, in numerous instances, more of a mistake than the narration of the fact itself.

The angry disposition which this fish is believed to manifest to all the animals of the Whale tribe, has been often remarked by sailors; and the manner in which it is shewn has obtained for it the name of Thrasher. The lashing of the sea by its tail has been known to put to hasty flight a herd of sportive Dolphins; and instances are reported where a Sword-fish on the one hand, and a Thrasher on the other, have persecuted a large Whale in the severest manner, perhaps even to death; and yet it is not easy to imagine why such terror should be felt at the presence of such an enemy; for its teeth could not do injury, and it does not possess any other weapon of offence. The motive of the persecution also on the one side is as unintelligible as fear of the Thrasher is on the other.

The Thrasher is not uncommon on the western and southern

coasts of Britain in the summer, and is sometimes caught entangled in drift nets. I have been informed of two of them taken in this manner at one time, and from the circumstances attending the capture of these and others, we may conclude that the force they exert in the water is very great; as indeed we might also conclude from the length and flexibility of their tail. They had carried the whole body of the net before them, until it had been thrown back over the head ropes; by which means they had fallen into a bag, from which they had not been able to extricate themselves.

It is one of the fishes that has been reported to receive its young ones into its stomach as a place of shelter; and Rondeletius informs us that he saw them cut out from a Thrasher that had been taken. The fishermen supposed that they had been swallowed through hunger; but from their being alive and uninjured, he felt no doubt that his own conclusion was the true one.

I found young herrings in the stomach of one I examined.

From an intimation of Ælian, it appears probable that the Greek fishermen were in the habit of seeking after it for food, (Var. Hist., B. 1,) and for this purpose Risso pronounces it very good.

It is worthy of notice in this place that the author who first described this fish, was the well-known Dr. Joannes Caius, (John Keys,) who wrote a work, "De Canibus Britannicis," at the end of which, 'de rariorum animalium historia,' he gives an account of an example that had been taken in a net in the year 1569. Its length from the snout to the tail was seven (Roman) feet, and of the tail seven feet and a half. He calls it Cercus, and derives the name from the Greek Karcos, because of its tail:—a curious etymology for an English word. The flesh he compares to that of a Salmon, but confesses that it was not quite as agreeable to the palate as the flesh of that fish.

The extreme length of an example was in a straight line ten feet ten inches and a half, and along the curve eleven feet eight inches; three feet four inches and a half round where thickest; conical from the snout to the pectoral fins, and thick even to the tail, which from the root is five feet and a half long, and consequently more than half the length of the body. Eye prominent, round, hard, and four inches from the snout;

iris blue, pupil green; nostrils small, not lobed; mouth five inches wide, shaped like a horse-shoe; teeth flat, triangular, in two or three rows, not numerous; gill openings five. Pectoral fins wide at the base, pointed, eighteen inches and a half long. The body measured along the curve to the first dorsal fin two feet five inches, the fin triangular; from the first to the second dorsal fourteen inches and a half; this and the anal very small, which is an important part of the generic character, as assigned by Rafinesque and Swainson, the former being one and three quarters, and the latter one inch wide at the base; abdominal fins rather small, and triangular; above and below at the base of the tail a deep depression. Extreme breadth of the tail, including both lobes, thirteen inches; the upper lobe narrow through its length; and at four inches from its extremity on the lower margin is a triangular process. Lateral line central and straight; skin smooth. Colour of the body and fins dark bluish, mottled with white over the belly.

An example of this fish, taken in the Mount's Bay, in Cornwall, measured twelve feet in length, which may therefore be taken as about the usual length; but in November, 1799, an example was obtained at Dieppe, in France, as reported by Lacepede, which measured fifteen feet in length, and five feet in circumference; and which therefore exceeded in magnitude that which is described by Caius. Dr. Smith is reported to have discovered spiracles or temporal orifices, of very small size, which therefore are named in the characters of the genus; but after search I was not able to find them. The colour seems to vary from a decided blue to dark, with little perceptible of the former colour; and it would also appear, if we are to be guided by the description given by Pennant, that some variation may also take place in the form of the tail; which he describes as passing straight backward, which was not the case in the example I have described.

LAMNA.

The snout conical; body disposed to a rounded form, with a prominent ridge at the side near the tail; gill openings wide. Teeth long and pointed, with a process on each side near the root. An anal fin.

PORBEAGLE.

Squalus cornubicus,	Turton's Linnæus.
Lamna cornubicus,	Cuvier.
Isurus oxyrhyncus,	Rafinesque; but his figure is exceedingly bad. The genus *Isurus* was founded by Rafinesque, but his definition that the lobes of the tail are equal, must not be taken literally.
" *cornubicus,*	Gray; Catalogue of British Museum.
Longnez,	Lacepede and Risso.
Lamna cornubica,	Fleming; Br. An., p. 168.
" "	Jenyns; Manual, p. 500.
" "	Yarrell; British Fishes, vol. ii, p. 515.
" "	Donovan; pl. 108, but the figure is not satisfactory.

In this place it is proper we should notice a fish, which has borne the name of the Beaumaris Shark, from the place in North Wales where it was first taken; and concerning which much doubt has existed among naturalists, as to whether it is a distinct species or a variety of the Common Porbeagle, to which description represents it as bearing a general resemblance. Cuvier regarded it as a separate species; but his authority is of less weight, as he never possessed the opportunity of examining a specimen. Mr. Yarrell, also, in the first edition of his "History of British Fishes," has given it as different from the Porbeagle; but in the second edition of that work, he has

placed them together, and he assigns as his reason for this change of opinion, that he had had opportunities of examining four examples, which had been taken on different parts of the coast since 1837—the date of the publication of the first edition of his work—and which has induced him to believe that the differences observed between them and the more frequent forms, are only the effects of greater age.

Something like this I have myself noticed; for in the largest Porbeagle I have ever seen, and which measured almost nine feet in length, the snout appeared much smaller than in apparently much younger examples; and the first dorsal fin appeared, even by measurement, nearer to the tail than is usual in the Porbeagle. The lateral ridge was carried along so high on the side, as to be nearly level with the flattened surface of the back, near the setting on of the tail; from which position it was bent down suddenly to pass along its usual situation on the tail, in the manner represented in Donovan's plate 108. The two divisions of the tail were nearly equal; and so different was the appearance of this fish from that of the smaller and more common examples of the Porbeagle, as to leave the impression that it was specifically distinct; until a further examination removed all doubt on the subject.

This fish is not noticed in the tenth edition of Linnæus's System, having probably been confounded, as were several others, with the White Shark; until it was distinguished from the latter by Dr. Borlase, in his "Natural History of Cornwall."

One of the first of the two examples of the Beaumaris Shark, as described by Pennant, was a female, and contained young ones within it, which, however, were only two in number; a circumstance which would lead us to suppose that it is a scanty breeder. But it is to be regretted that those young ones were not more closely examined and described; as from them we might have been able to collect more clearly the proof of their being either of a new or a well-known and recognised species.

The Porbeagle is a common visitor on the western coasts in summer, and not unfrequently it wanders along the eastern borders of England, and even of Scotland. An instance has been known of its having been taken even in Orkney. It usually proceeds in small scattered companies, preying on

pilchards and herrings, and other small fishes that then abound. Risso represents it as swift and eager after prey, and certainly it is not less fierce than other Sharks; and I have been informed of an instance, where in the prospect of being taken, it sprung at a fisherman, and tore a piece out of his clothing. The teeth, which present a formidable array of spears, are less formed for cutting than for seizing and holding its prey; which therefore it appears to swallow whole. I have found the remains of cartilaginous fishes and cuttles *(Sepiæ)* in their stomachs; and in one instance full-grown hakes.

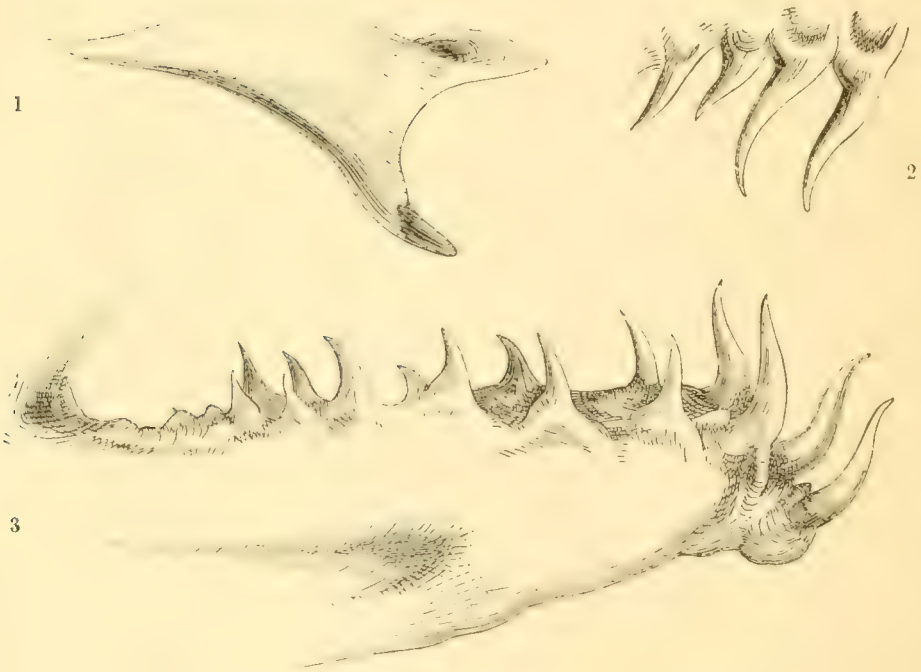
According to Risso it is an article of food in the Mediterranean, and he goes so far as to say that as such it is much esteemed. This is a piece of luxury to which our fishermen and the public have not yet attained; and consequently with us it is only employed as manure.

The spiral valve in the entrails of this fish is strongly marked.

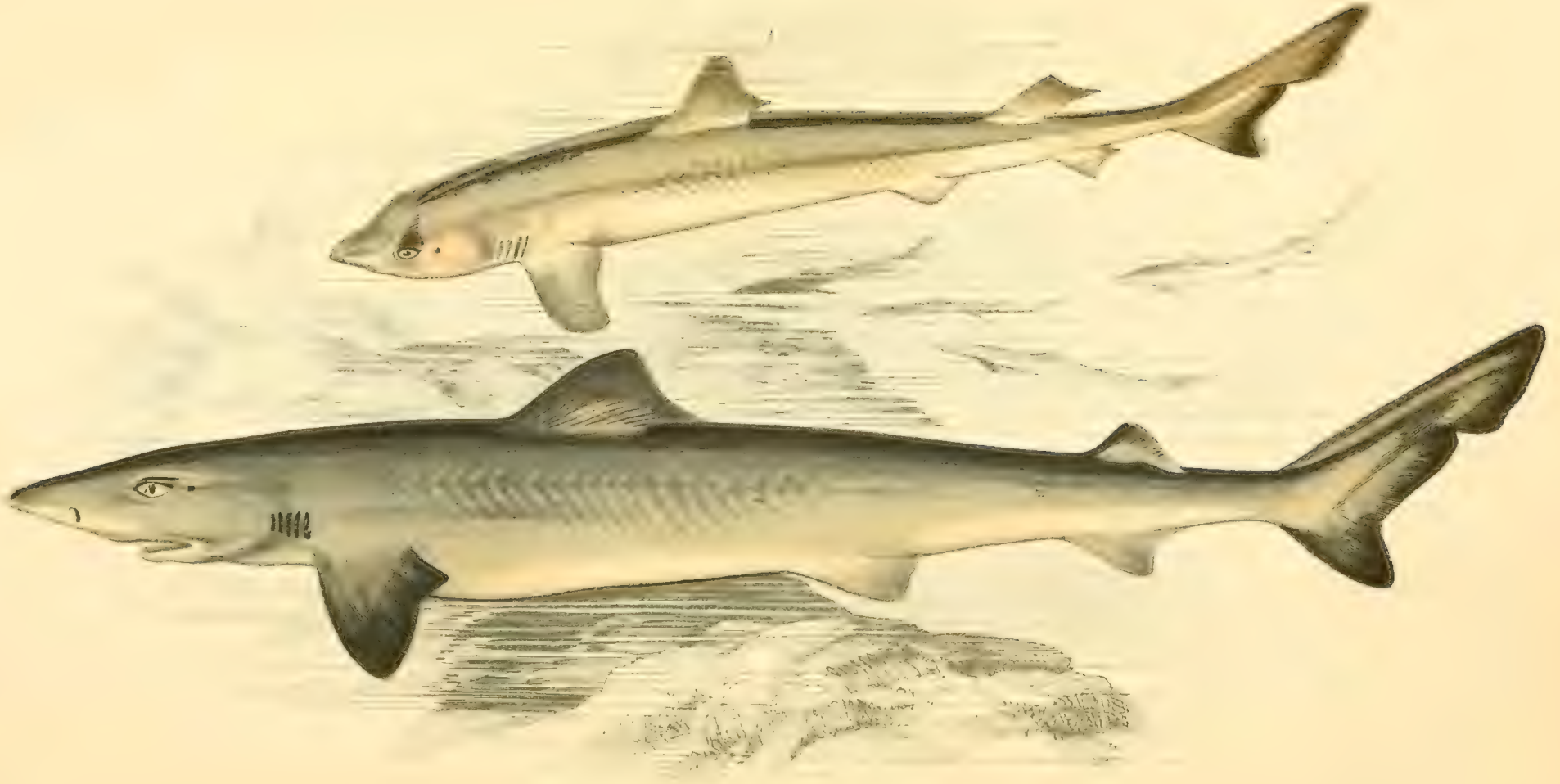
The example described was four feet in length, and two feet in circumference just before the pectoral fins; the appearance, therefore, solid and heavy, and explaining the meaning of its name—the hog-hound. The snout prominent and round, thickly covered with small apertures; the nostrils single, small, and not lobed; mouth large, armed with rows of sharp prominent teeth, each tooth with a smaller process at the root on each side, the rows of teeth varying according to size, but in the fish described only two uncovered. Eye prominent, no spiracle; the gill openings reaching up the side of the body, their extent increasing from the first anteriorly. Body round, depressed nearer the tail, with a notch above and below at the root of that organ, a prominent ridge at the side of the body near the tail, and a slight one below it on the tail itself. First dorsal fin elevated, and triangular; the second dorsal and anal small and opposite each other; upper lobe of the tail without a notch in some examples; but it extends beyond the lower, contrary to the definition of Rafinesque. The skin slightly rough. Colour black on the back and fins, lighter on the sides, and white below.

I have been informed of an example that weighed eight hundred pounds, and another of large size will presently be described. This latter had the remarkable singularity of being much disfigured by a large lobulated cancerous tumour in its

mouth, which also had eaten away the upper lip on the right side, and which, occupying the roof of the mouth, had passed down the gullet towards the stomach. This disease bore a near resemblance to the cancer in the higher race of animals, and appears to have arisen spontaneously. A more lengthened degree of suffering was happily cut short by its becoming entangled in a fishing-net, from which it was not able to deliver itself.



1.—Largest Tooth of Porbeagle, (natural size.)
2.—Upper teeth. 3.—One ramus of the jaw.



TOPER AND YOUNG.

IX

GALEUS.

The form of the body tapering; spiracles or temporal orifices behind the eyes; the gill openings moderate; an anal fin. Teeth sharp.

TOPER.

WHITE HOUND. PENNY DOG, the young ones called MILLER DOG, from their light grey appearance.

Squalus Galeus,	Artedi and Linnæus.
Galeus Aristotelis,	Jonston; p. 25.
Canis Galeus,	Willoughby; p. 51, tab. b. 6, but the tail is badly expressed.
Galeus vulgaris,	Fleming; Br. An., p. 165.
" "	Jenyns; Manual, p. 501.
" "	Yarrell; British Fishes, vol. ii, p. 509.
Squale Milandre,	Lacepede. Risso; Ichthy., p. 32.

This is a common and rapacious fish, devouring any living thing it is able to overcome; but it appears to swim lower in the water than the Blue Shark and Porbeagle, as few complaints are heard of the injury it inflicts on the fishermen's nets.

The young are produced in summer, and I have found them well developed so early as in May. The whole brood is usually produced at one birth; although I have occasionally met with an instance where a few eggs have been ready to take the place of a large number that were ready for exclusion. On examining a large female, I found twenty-one young ones, all of one size, about a foot in length; ten in one receptacle, and eleven in the other. The egg attached to each young one, and not yet absorbed, was scarcely an inch in diameter, pear-shaped, with a funis about six inches in length. The largest number of

young I have met with was thirty-two, but fifty-two have been found. They remain near us in the winter, for I have met with them in January; being then about twenty inches in length, with three rows of teeth; the outer or oldest row of which had only one notch on its edge. At this time the older fishes have left the coast, and perhaps have retired to deeper waters.

Among ourselves this fish is little regarded as food; but Willoughby found it exposed for sale in the market at Rome; and fishermen inform me that French people freely purchase it for the same purpose.

It grows to the length of six feet, but is not often found of that size. The shape is somewhat round and slender, especially towards the tail. The snout depressed and lengthened, and diaphanous towards the borders; in fish of full size a narrow fold of skin passes over the eye, but I have not observed it in the young examples. Spiracles small and near the eye. Nostrils small, near the border, and not lobed; mouth far beneath; teeth triangular, serrated on the posterior or inner edge only; their position alternate in the rows. Gill openings above the origin of the pectoral fins. The first dorsal fin nearer the head than the tail, the second opposite the anal, the pectorals wide near their origin. Upper lobe of the tail notched. Colour a dark ash above, white below. The eye is oval, and the tablet on which the globe of the eye is placed in most, if not all the Sharks, as already mentioned, is less elevated or clearly marked than in the other species with which I am acquainted. There are also some other particulars connected with the eye of this fish, which appear to imply different powers of vision from those of other species of Sharks. The outer coat or capsule of the eye-ball is firm, but it becomes thinner and more yielding at the transparent cornea; which, consequently, when pressed by the director muscles, must become more convex; as we also find in some birds, which thus possess the faculty of adjusting vision to different degrees of distance. The pupil is very small. A nictitant membrane, formed of a doubling of the eyelid, is capable of being raised from the inner angle of the eye, to cover two thirds of the eye-ball.

SMOOTH HOUND.

MUSTELUS.

This genus resembles *Galeus* in the shape of the body and the possession of spiracles; but in addition the teeth are absolutely flat, without points.

SMOOTH HOUND.

RAY-MOUTHED DOG. SKATE-TOOTHED SHARK.

Squalus mustelus,	Linnæus.
Mustelus lævis,	Jonston, p. 26. Willoughby, p. 60 Tab. B. 5.
" "	Cuvier. Fleming's Br. An., p. 166.
" "	Yarrell; British Fishes, vol. ii, p. 512
" *vulgaris,*	Gray; Cat. Br. Museum, p. 127.
" "	Jenyns; Manual, p. 502.
Squale Emissole,	Lacepede and Risso; Icthy., p. 33.

The Smooth Hound is common, but not abundant, in the west and south of the kingdom in summer; and it has been sometimes taken in Scotland. Although I have known it caught in February and March, it is not usually within the reach of our fishermen until the beginning of May or June; and that they have come from a considerable distance is rendered probable from the kind of hooks sometimes found in them, and which they have separated from the line. These hooks have been formed with scarcely anything besides a bend or bow and a very short shaft; such as our fishermen suppose to be in use on the coast of Spain.

It seems to be less prolific than the generality of Sharks. In the month of November I have found it with eleven young ones just ready for exclusion, and all of one size, without

any eggs in reserve. The heads of the unborn young were longer in proportion to their bodies than those of the young Picked Dog.

The food of the Smooth Hound usually consists of crustaceous animals, which it crushes with its pavement of teeth; but it takes a bait.

It grows to about three feet in length: one of that size measured a foot in girth close behind the pectoral fins. The head flat and wide; eyes two inches and a half from the snout, three inches asunder, and oval; a longitudinal chink below the eye; spiracle below the line of the posterior angle of the eye. Mouth opposite the eyes; teeth blunt, covering the jaws like a pavement; corners of the mouth lobed; nostrils complex, not lobed. Body rising behind the head; a slight ridge along the back; slender near the tail, the upper lobe of which is broad and notched. The skin smooth and yielding; lateral line straight. Pectoral fins wide, the first dorsal nearer the head than in most Sharks; both dorsals fleshy, thick at the base and rounded above. Ventral fins opposite the space between the dorsals, but posteriorly; the anal smaller than the second dorsal and nearer the tail. Back and sides ash-coloured, white below, but in some instances pink or reddish; numerous white spots on the back and sides, in some examples regularly placed along the lateral line. These spots are not a constant character in this species and some others of this family, but are most numerous in the younger fishes, and perhaps disappear in the old.

PICKED DOG AND YOUNG.

SPINAX.

In addition to the general characters of the genera *Galeus* and *Mustelus*, this genus is distinguished by wanting an anal fin, by a more simple tail without a notch, and small cutting teeth.

PICKED DOG.

SPUR DOG. BONE DOG. HOE, in Orkney; in Cornwall the male is called SKITTLE DOG. Pre-eminently this fish is called

THE DOGFISH.

Galeus acanthias gazæ,	Johnson; *Mustela spinax, sibi,* p. 27, tab. 8, f. 5.
" " "	Willoughby; p. 56, tab. b. 5.
Squalus acanthias,	Artedi and Linnæus.
Squale aiguillat,	Lacepede. Bloch; pl. 85.
" "	Risso; p. 40. Donovan; pl. 82.
Common dogfish,	Fleming; Br. An., p. 166.
" "	Jenyns; Manual, p. 506.
" "	Yarrell; Br. Fishes, vol. ii, p. 524.
Acanthias vulgaris,	Gray; Cat. Br. Museum, p. 131.

Regarding the scientific, or what is termed the trivial name of this fish, there is a degree of uncertainty in the older authors, arising from the fact that there is another species which is also distinguished by bearing a similar arming of spines on the back; and which is in some other respects much like our

common Dogfish, but which may be known from the latter by having its nostrils close to the snout, instead of being midway between that and the mouth. Its colour is also different, and that too in a remarkable way; for, as Lacepede observes, contrary to what is found in most fishes, and among the Sharks more especially, while the back is only dusky, the belly is very dark, and almost black. This part is also distinguished by having tubercles. It is a smaller fish than the British species, and is found in the Mediterranean, but we have no means of knowing what are its distinguishing habits, except that it appears to be less a wanderer than the Picked Dog. It was Linnæus who first definitely fixed the name of *Acanthias* to the last-named fish, and *Spinax* to the other species, which has not been taken in Britain.

The Picked Dog is the smallest, but by far the most abundant of British Sharks. It is found at all seasons on the coast of every part of the United Kingdom, but in the greatest numbers in the west and south; where at times they exist in such multitudes, as to occupy the full extent of sea for scores of miles; and twenty thousand have been taken in a sean at one time, without any apparent lessening of the numbers. Unlike other Sharks, and almost all other fishes, it is not affected by cold or heat in the severest seasons; and I have known them caught when from severe cold every fish, except a straggling few of the Gadoid family, as ling, cods, or haddocks, had gone for shelter into deep water.

From the numbers of these fish that are met with, it may be concluded that this species is exceedingly prolific; and in this respect they differ so far from the others which frequent our coasts, that for nine or ten months in the year, the female produces young almost every day; the eggs existing in the formative organ to the amount of many scores at one time, and descending in successive pairs into the two branches or horns of the receptacle, as the former are excluded; and not unfrequently their descent is by twos and threes on either side. Sometimes a couple of young ones are seen attached to one egg; and as their development is speedy, there is no possibility of calculating the numbers which each female is capable of producing in a season.

The young ones, with teeth and jaws too feeble to assault

a full-grown fish, are yet found accompanying their parents in the pursuit of prey; and it is not to be doubted that the newly-born of a variety of kinds of the common sorts of fish are the ready food on which they subsist, until they have acquired more enlarged powers of depredation.

But the full-grown fish, existing as it does in such large numbers, is not inferior to the much bulkier members of this predaceous race in the annoyance, if not absolute injury, inflicted on the fishermen. Nets suffer greatly from their depredations, as well by the jagged bites with which they destroy the texture of the twine, even where it is not cut through, as by the pieces cut from the fishes that had become entangled in the meshes, but which are thus rendered unfit for the market. To lines they are not less injurious; and it has frequently happened that fishermen, who have gone to sea with a good supply of hooks, have been compelled to return from having had the whole cut from the line by the teeth of the Picked Dog. It is the belief of fishermen that these annoying enemies are often in the habit of taking their station at mid-depth of water, and watching until a whiting or other small fish has taken the hook; when they cut the line to intercept the capture, and so carry off the prize without risk to themselves.

When however they have chanced to swallow the hook, or when entangled in a net, it is the scarcely probable belief of fishermen that their escape is not commonly by means of their teeth, but by the cutting powers of the spines, which stand in front of the dorsal fins; in the use of which there is no doubt they possess intuitive knowledge. If laid hold of by the head, they will bend the back into a bow, and so bring the spines into a favourable position for a backward stroke, which is effected by a sudden and violent return of the body to the straight posture. The spines are thus thrust asunder in such a manner as to tear any thing that lies within reach of the stroke; and as a defence this action is so effectual as to demand from the fisherman some care in the handling of it; for the fish is able to direct its spines with a considerable degree of precision; although the effort is not always sufficient to save it from the clutches of other voracious inhabitants of the seas; and I have accordingly found it in the stomach of Ling, Blue Shark, and other fishes.

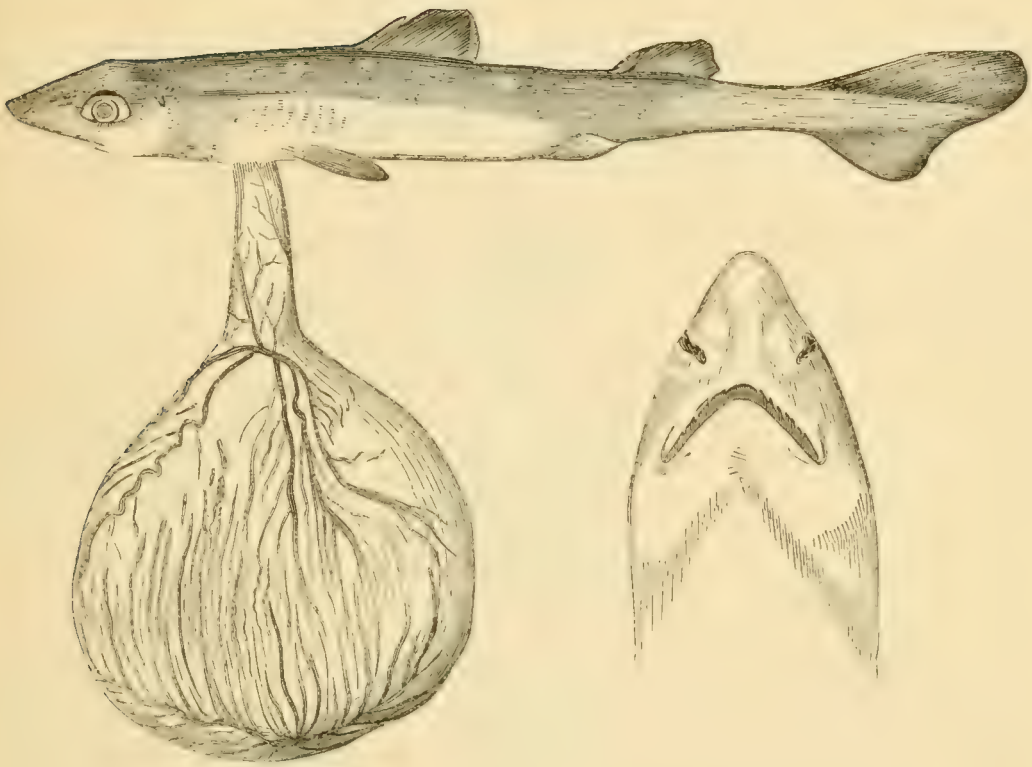
This species is a common article of food with fishermen, especially in the west of England; and is valued also by some who are far above the necessity of classing it with their ordinary articles of subsistence. It is used both fresh and salted; and Lacepede, who speaks unfavourably of its flesh, informs us that in the north of Europe the eggs, which are about the size of a small orange, and consist solely of a pale-coloured yolk, are in high esteem. If prejudice could be got over, there is no doubt that they might form an agreeable, as well as a very nourishing article of food.

The following, among many other instances, will shew the error of some naturalists, who have expressed the belief that examples of abnormal formation will not occur where animals are absolutely beyond the control of civilized man:—A friend was in possession of a Picked Dog that had a pair of heads, with the separation complete so far back as behind the pectoral fins; and the fisherman who obtained it informed me that when found in his boat, where it must have been dropped after the parent had been caught, the egg was attached to it. Distortion in the hind parts is not uncommon, although only in fœtal instances, since such examples could not long exist at liberty.

The usual length is from eighteen inches to two feet; the females, as in most species of this great family, being the largest, and I have seen an example, in which the blunted dorsal spines betokened age, that weighed twelve pounds. The head is depressed, the snout projecting, mouth far under, and armed with flat cutting teeth; nostrils midway between the mouth and extremity of the snout. The tongue thick and fleshy; eye large, spiracles rather elevated; gill openings five, at the origin of the pectoral fins. The body round and tapering; dorsal fins two, on the anterior border of each a stout, sharp, and slightly curved spine. The first dorsal at about midway between the pectorals and ventrals; no anal fin; pectoral fins wide; upper lobe of the tail short, wide, and simple, without a notch; ventrals short, concealing the vent. The upper parts a dark ash-colour, below white.

I have seen what appeared in all other respects to be no other than a variety of this species, but which was all over of an intense black colour, except a narrow line of dusky yellow

that passed along the belly. Examples also are often found dotted over with white spots, but these seem to disappear with age.



Fœtal Picked Dogfish, with the ovum attached.

Head of Young Toper, under side.

SCYMNUS.

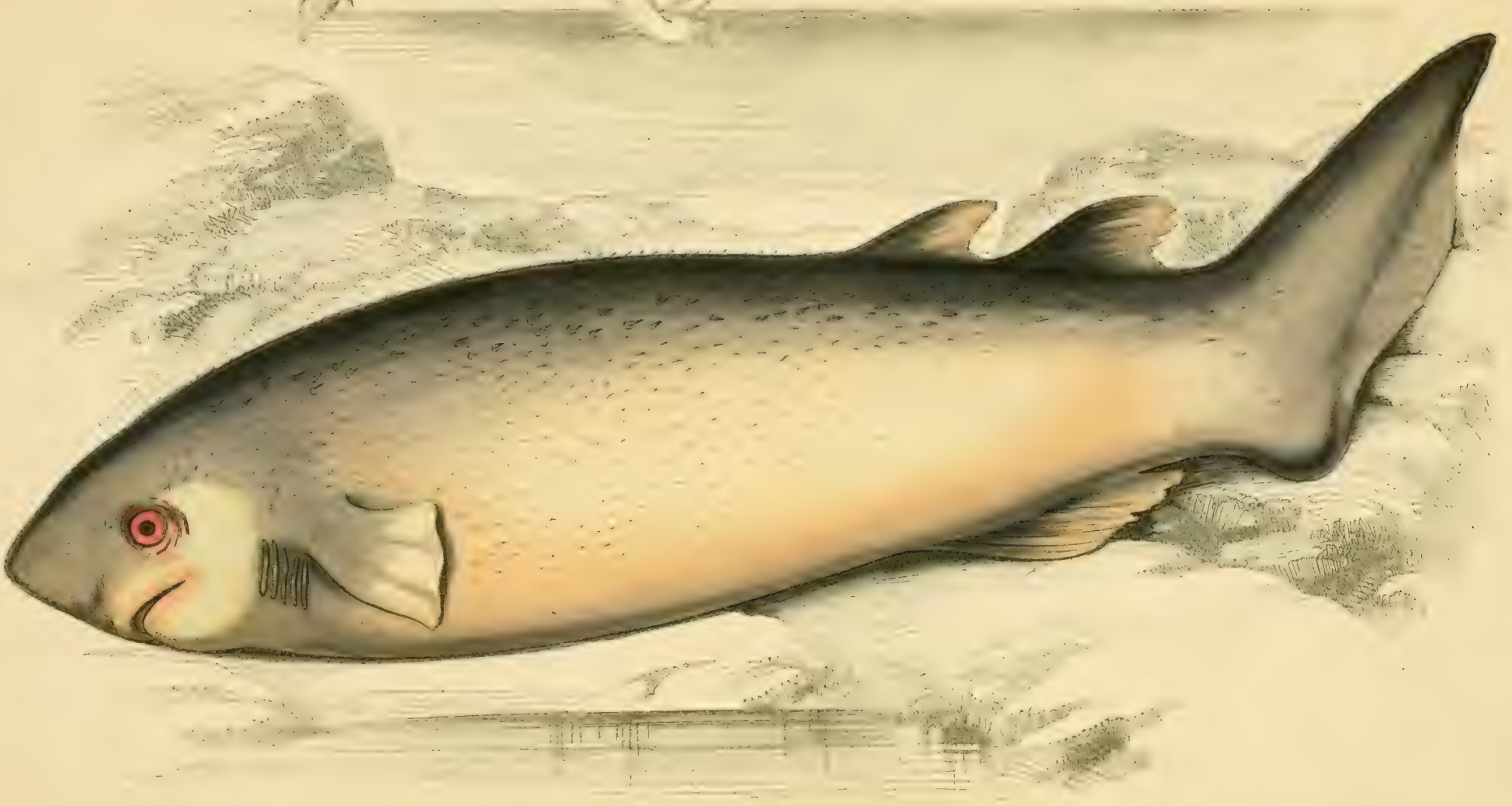
The first dorsal fin before or over the abdominal fins, the second dorsal behind them. Teeth in the upper jaw straight and narrow, in the lower jaw crooked, pyramidal, and equal-sided. No anal fin; a short tail.

SPINOUS SHARK.

Squalus spinosus, Turton's Linnæus.
Squale Bouclé Lacepede and Risso.
Echinorhinus spinosus, Yarrell's Br. Fishes, vol. ii, p. 534. Taken from a figure by Dr. A. Smith, who gives it the name of *Echinorhinus obesus*—the *E. spinosus* of Blainville. It is not easy to suppose that Mr. Yarrell's more lengthened figure at p. 532 can represent the same fish; and at least his second figure alone can be quoted for the examples found in Britain.

The Spinous Shark was not known to naturalists before the latter part of the last (eighteenth) century, and at present little more is ascertained concerning it besides its figure and the extent of sea through which it is distributed. Dr. Smith obtained it at the Cape of Good Hope; it seems scarcely rare in the Mediterranean, and in Britain it has been taken in Yorkshire, at Brixham, and three or four times in Cornwall. Its haunts probably are in very deep water, and consequently little of its peculiar habits can be expected to become known, except by some fortunate accident of uncertain occurrence. We must rest content, therefore, in collecting what scattered notices exist, with the addition of the very little obtained by observation.

It is evident that this fish keeps near the ground in its favourite places of resort, and that they are only a few stragglers



SPINOUS SHARK

which have shewn themselves to human research. Its clumsy shape, and the small size of the fins and tail, are evidences of its possessing but little activity, although, when put forth, its muscular strength is great, as is proved by the powerful resistance it has offered when drawn up on a line. Its habitual food is uncertain, and its teeth do not appear well fitted for crushing hard substances; but in Mr. Fox's example there were remains of crustaceans (crabs, etc.,) in the stomach, and no fishes. The extent of its mouth, seven inches, in a fish which measured only five feet and a half in length, with the form of the teeth, appear to shew it capable of swallowing a large prey. The liver of this example yielded a gallon of oil.

This description is derived from an example taken near Falmouth, which measured eight feet six inches in length, and which, therefore, may be supposed to be about the dimensions it seldom exceeds. Mr. Charles Fox met with one that was taken towards the end of September, 1835, about a mile from land, near Helford, in Cornwall, which measured five feet and a half. Lacepede speaks of one that measured no more than four feet, and Risso of a specimen so large as to weigh about six hundredweight. For the figure of the first-named example I am indebted to the kindness of William P. Cocks, Esq., of Falmouth, to whose skill and industry naturalists lie under great obligation for communications on several kindred branches of science; opportunities of studying which are afforded him by his residence in that town.

The specimen referred to, eight feet six inches in length, was in depth in a straight line two feet, and consequently it was a thick and lumpish fish. The tail from its insertion was one foot eight inches in extent. The snout blunt; eye round and prominent. The body covered from the eye to the tail with sharp spines; but there were none in front of the eyes, nor below a line extending from the eyes to the pectoral fins, nor on the belly. Gill orifices five, short and close together, placed below the root of the pectoral fins. The latter fins short, placed higher than is represented in Mr. Yarrell's figure, narrower at the root than at the termination, and ending abruptly. Dorsal fins nearer the tail, and close together; the first the smallest, over the ventrals; the posterior edges irregular; no anal fin. The tail ascends from its root, the fin part narrow,

waved, and widest at the middle; the lower lobe rounded and obsolete. On the back the colour dark; lighter, with tints of blue, along the upper sides and tail; yellow with reddish tints on the belly; the fins edged with reddish flesh-colour. There are no spines on the snout and fins, and those on the body are nearly straight.

Mr. Fox describes these spines as being tubercles with recurved points, and as such they are represented in Mr. Yarrell's engraving. Lacepede says they are tubercles of unequal size, large and round at the base, as in the Thornback Ray, with one or two crooked points to each; and Risso's description expresses nearly the same thing, but he represents the second dorsal fin as of very small size.

GREENLAND SHARK.

Squalus borealis,	Scoresby; History of the Arctic Regions, etc.
Scymnus "	Fleming; Br. Animals, p. 166.
" "	Jenyns; Manual, p. 506.
" "	Yarrell; Br. Fishes, vol. ii, p. 527.
Dalatias microcephalus,	Gray; Catalogue Br. Museum, p. 132.

At a time when every large example of this family was supposed to be the Great White Shark, so formidable to sailors in warm climates, the Greenland Shark had that name affixed to it; and accordingly in Crantz's history of that country, and in other writers of about the same age, we find the *Squalus carcharias* in the list of fishes of these northern seas. It was Captain Scoresby, in his "History of the Arctic Regions," to whom we are indebted for the first knowledge of it as a separate species; and nearly the whole of what is even now known of its habits is due to his observations.

Never having had an opportunity of examining an example of this fish, our description will be derived from what the above-named author has given us, with additions from the "History of British Animals," by Dr. Fleming; which, taken together with a description of the teeth and jaws presently to be referred to, will afford materials sufficient to enable any one to identify the species, if it should chance again to wander to our shores; an accident, it is true, not soon to be expected, since only three or four instances are recorded of its having appeared so far south of the icy sea, and one only on the coast of France; driven so far from its accustomed haunts probably by disease; which appears to be a not uncommon cause for the presence of fishes in regions where they are strangers.

According to Scoresby the length is from twelve to fourteen

feet, and the girth from six to eight feet—thus being among the stoutest of this family of predaceous fishes. The mouth is large, extending nearly across the under part of the head; the teeth in several rows, serrated in one jaw, and lancet-shaped and toothed in the other. Pupil of the eyes an emerald green, the rest of the eye blue. The skin rough; ventral fins separate; no anal fin. It has spiracles; the gill openings five; colour ash grey. It is probable that Scoresby trusted to his figure for a more particular representation of this fish; but for what remains we have recourse to Dr. Fleming. His character of the species is:—the first dorsal fin larger than the second, more advanced than the ventrals. Teeth in the upper jaw broad at the base, suddenly becoming narrow and lanceolate, with the cutting edges rough; in the lower jaw the teeth are pyramidal, compressed, the cutting edges crenulated, a little convex on the fore edge, and subangularly concave on the hind edge. Pectorals large; ventrals elongated, the two sides nearly parallel. It appears that the tail is short. Fleming says he was in possession of the jaws of an individual, presented to him by a Mr. Simonds, and which was caught in his presence in the Pentland Frith. Another example was found dead at Burra Frith, in Unst. A third British example is recorded by Mr. Yarrell, and is preserved in the Museum of the University at Durham. It appears that another was found dead at the mouth of the Seine, in France. Scoresby represents this Shark as a decided enemy to the Great Greenland Whale, both alive and dead. In the former case it bites pieces out of its flesh, and the tail of this animal is often found to bear marks of the injury; so that Whales avoid the place where they abound. But the depredation is more decided when the Whale is dead. It scoops large pieces of the blubber from the body, and gorges itself to the full, without being terrified or driven away by the presence of men, even if pierced through with a spear; for, like the generality of its race, it is exceedingly retentive of life, and apparently insensible to wounds. Its ferocity, however, is expended on its prey, for it does not inflict any injury on the men employed in cutting up the Whale, and even seems to be insensible to their presence. In the absence of other prey, however, it has been known to attack a man. Its season and mode of producing its young do not appear to have been

noticed by any one but Crantz, who says it produces four at a birth.

I owe it to the kindness of Charles W. Peach, Esq., of Wick, in North Britain, that by the possession of the under jaw of this fish, obtained from Greenland, I am able to give a description, with a representation, of its teeth. They are of remarkable shape and number, as well in regard to the form of the individual teeth as of their situation; numbering forty-nine in all, as they stand along the prominent edge of the jaw; which is unusually thin for the magnitude of the fish. These teeth at the middle touch each other, with a little overlapping, but their points diverge. The most prominent portion has a sharp point, which is bent horizontally, and the upper edge becomes thus the cutting portion, the thin body of the tooth being spread out at the side, with a depression by which one is made to lean on and receive support from another, and the whole supported on the gum by processes which bear the likeness of fangs. On the inner or formative side of the gum are five rows, with their cutting edge and point downward, as not yet raised from the investing membrane. The sixth row stands erect, ready for use, and resembles the edge of a saw; and on the outer side, sunk to a level with the roots of the former, is the row that lately occupied the superior position, and where it serves as a guard and support to its successor. Of the lowest row of all, the cutting portion is wholly lost, and the fangs are loosening in order to fall away. There exist, therefore, nine rows of teeth visible; and I judge them to be of quick formation and progress, with also a rapid shedding; but at no time is more than one row of actual service to the creature for the purpose of cutting. In former times the Greenlanders used these teeth as a saw. According to Crantz, in Iceland and Norway this fish was used as food, but the Greenlanders rejected it.

For an engraving of the teeth see page 66.

SELACHE.

Dr. John Edward Gray's character of this genus, which he names *Cetorhinus*, is, snout short and blunt; the spiracles small; gill openings very large, passing almost entirely across the throat, and upwards towards the neck. Teeth numerous, very small, conical, and without side notches. Scales with small curved points bent in all directions, so that the skin feels rough each way. But Dr. Fleming says that the Basking Shark is smooth when the hand is passed from head to tail.

BASKING SHARK.

SUNFISH. SAILFISH. HOE-MOTHER, in Orkney.

It was not known to Linnæus, in the tenth edition of his System.

Squalus maximus,	Turton's Linnæus.
" "	Fleming; Br. Animals, p. 164.
" "	Jenyns; Manual, p. 503.
" "	Yarrell; Br. Fishes, vol. ii, p. 518, but not his figure.
Selachè "	Cuvier.
Squale Tresgrand,	Lacepede.
Cetorhinus maximus,	Gray; Catalogue Br. Museum, p. 129.

It is rightly observed by Cuvier, and also by Mr. Yarrell, that the difficulty of taking a correct likeness of this and other large fishes, as well as other marine animals, as they lie irregularly on the beach when dead, perhaps imbedded in sand or mud, or from the manner in which they float, will account for the incorrect representations of them which exist; to which must be added the thronging of a crowd of spectators, who press on the object, or stand in the way of the draftsman. It is also difficult to preserve the larger examples of such fishes, with

due attention to their natural shape; on which account a figure taken from a stuffed specimen is likely to be less exact than even a drawing made under the first-named inconveniences. The figure I give is from a specimen taken in Cornwall before the example had fallen into the hands of preservers; and the description is from the same, enlarged from other sources, and especially from the authority of Dr. Fleming, in his "History of British Animals."

The food of this fish is not known, and it is doubtful whether it takes a bait. Of course no line would be sufficiently strong to hold it; and I have been told that the example referred to in the description, of thirty-one feet in length, was able to break a six-inch hawser, and the doubling of a net alone was able to control its strength.

We also refer to the circumstance that this fish has been confounded with the Whales, to which mistake its quiet and peaceable habits did not a little contribute; for there are times when it appears to enjoy the sunshine and a calm, and then it basks so much at ease as to suffer itself to be approached without shewing any sign of being alarmed, or of a disposition to inflict injury. From this habit it has received the name by which it is now generally known, and from which also it has been termed the Sunfish; although this latter name has led to a remarkable error in Lacepede; who, mistaking it on that account for the *Orthogoriscus mola*, which is also called the Sunfish, has described the latter as having been found of the surprising length of twenty-five feet. By his reference to Borlase's Natural History of Cornwall, his mistake is rendered plain.

I have already taken occasion to mention the confusion that has resulted from the supposition, so long retained, that this fish was to be classed among the Whales; and a remarkable and a somewhat amusing result was the consequence of the error; which has had the effect of unexpectedly bringing us into acquaintance with it under circumstances the least to be expected. Whales, even of large size, were at one time a fashionable dish at noble and royal tables; and the Dolphin and Porpoise especially were admitted to that dignity so lately as in the time of King Charles the First; although Willoughby and others are so candid as to admit that they were not

thoroughly relished by all tastes. Rondeletius goes further, and says that the smell itself was so nauseous as to destroy the appetite for all besides that was on the table. The Leading Whale, *(Delphinus melas,)* which exceeds the length of twenty feet, was one of those that were thus elevated into a dainty; for it is to this that I would without hesitation refer the account given in "Notes and Queries," for June 27th., 1857, as an extract of an ancient chronicle of Jersey. From this we learn that in the month of May, 1575, a herd, eighty-seven in number, ran themselves on shore in that island, and were taken possession of by the Governor. Each one was a load for a waggon; but they were sent as presents, not for their oil, but as delicacies, to the principal persons of the island. Pomet, an apothecary, who wrote a History of Drugs in French, gives an account of the value then set on these Whales; but by comparing his text with the figure he gives of the creature so highly esteemed, there is no mistaking the fact that the Basking Shark is the species represented; and which had thus been advanced to an honour not properly due to it, without the discovery of that error by the guests; their politeness of course preventing the expression of dislike, however nauseous the taste of the dish might be.

This fish performs a regular migration along the west coast of Ireland, to the western islands of Scotland; and it is at this time that a regular fishery is carried on for taking them, of which the following description is given by W. Brabazon, Esq., in his account of the fisheries of Ireland:—"If the end of April is hot, the Sunfish (locally so named) are certain to shew above the water, and remain on the (Clew) bank till the middle of May. This large shoal of Sharks pass annually at this season along the west coast, on their way from the southern to the northern seas. They are taken on the Sunfish bank, situated about a hundred miles west of Clew bay, and extending many miles north and south. The fishermen there reckon it a day's sail out of sight of land. They are found on the bank in great numbers, and their large dorsal fin is seen at a great distance, as it rises three or four feet out of the water, while they lie motionless on the surface basking in the sun. At this time they are easily approached, and struck with a harpoon; the boat employed for this purpose approaches the fish with a

man in the bow ready to harpoon it; the line attached to the harpoon is two hundred fathoms long, and is coiled up in the bow; a man stands by with a hatchet ready to cut it, should it get entangled or foul of anything in running out. When the fish is struck, he will at the first dart carry out from seventy to a hundred and fifty or two hundred fathoms of line; he makes this rush to the bottom, where he rolls himself, and rubs his wound against the ground to free himself from the harpoon. The fishermen generally allow him an hour to tire himself before they begin to haul upon the harpoon line; they coil up the slack of it again, ready for him to make another rush, and play him in this way, sometimes for eight or nine hours, before they can get him to come to the surface; and when he does so they are ready to strike him with two or three more harpoons; and when these are fixed in him, they are able to pull him alongside the vessel with the harpoon lines; they then stretch him fore and aft along the vessel's side, and get a jowl rope round his head, and the bight of a hawser round his tail; they then give him two deep cuts, one on each side of the tail, with a hatchet. In his agony and his efforts to get free, he works his tail so hard, that he snaps the bone across where the cuts were made; they then cut flesh holes in the body of the fish on both sides, that will take a large rope through them; they then reeve ropes through these holes, and by hauling taut on the side of the fish next the vessel, and slacking away rope to the other side of the fish, it will cant him over on his back. They then split down the stomach, take out the liver, which is the only part they use for oil, and let the rest of the fish go adrift. There is no blubber between the skin and the flesh, as in the Whale, but the oil extracted from the liver is as fine as the finest spermaceti. The liver of these fish is generally two tons in weight, and makes from six to eight barrels of oil."

"These fish are most powerful in the water, and if harpooned in the shoulder they are very hard to kill; often carrying off the whole harpoon line; but experienced harpooners strike them in the body near the dorsal fin, rather low down, where it will go through into the intestines, or near the vertebræ towards the tail. They must be struck with great caution, as they will stave in the boat with a blow of their tail, if it is at all

within their reach. These fish are worth from thirty-five to fifty pounds each; and when so many as five hundred have been killed in one season, I think this class of fishing should be well attended to for the short season it lasts, if the weather be favourable to it; especially as it is at a time when other fish are out of season. The fishermen on the coast have a superstition that the fish will leave the coast if the bodies of those caught were brought to the shore."

"The Sunfish has been met in large numbers off Tory Island, and along the north-west coast of Donegal, where the Skerries men have found them at different times lying so thick over the ground, where their cod-lines were set, that they would not venture to put to sea in their open boats to lift the cod-lines, for fear of the Sunfish striking their boats. They have counted from sixty to a hundred basking in the sun, of a morning towards the latter end of June; and they did not lift their lines till late in the day when the fish had gone down. This proves that the Sunfishery is not confined to the Sunfish bank of Clew bay, but shews that if the weather is not suited for the fishery there, by following on the course taken by the fish, if the weather turns out hot, they may make a good fishing at any point from Clew bay to the Scotch Islands. It seems to me that as the Sunfish bank is the first soundings made by the fish coming in from the Atlantic, they may make a longer stay there than in any other part; but boats have gone round from the east coast to Sun-fish, beginning to work off Tory Island, and making a good season, though late, when they arrived there."

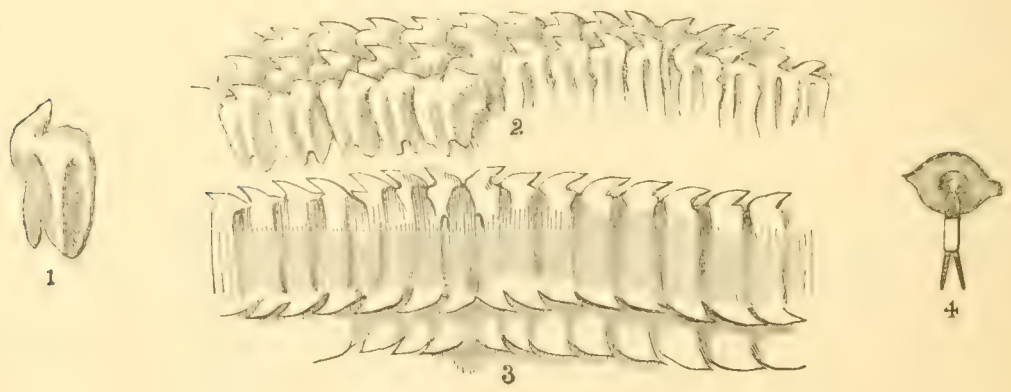
From the following paragraph, extracted from a newspaper of Orkney, it is rendered probable that the Basking Shark sometimes visits that neighbourhood:—"A very large Shark was caught (near Whalsey) by one of the fishing boats (in November.) None of the fishermen here ever saw the like of it. Its length was twenty-seven feet and a half; thickness sixteen feet; from its nose to the last gill seven feet; its mouth when open thirty inches across; the foremost fins five feet three inches; and the tail from point to point seven feet. The liver yielded one hundred and sixty-five gallons of oil, and was sold for £16 10s. The whole body could not have been less than six tons. It was caught by a six-oared boat, and the men had

great difficulty in getting it on shore. Instead of landing at six o'clock in the morning, it was seven at night before they got to the shore; and had they not been assisted by other boats' crews, they would not have managed it in two days. When caught it seemed to have taken a mouthful of herrings, and then rolled itself in the net. When the men began to haul in the nets, which were new, they found them twisted with the ropes five times round it. It died in a very short time, or the men would have run a very hard chance for their lives."

This is the largest of the Sharks, and of all true fishes; so that from its size, and partly from its habits, it was, as we have seen, formerly regarded as belonging to the class of Whales; and it was only so lately as the time of the British naturalist Pennant, that it was discovered, not indeed to be a Whale, but in all its characters to belong to the family of Sharks. If, however, we may take Ælian as our authority, its true position among the Sharks must have been understood in ancient times; for it is not easy to refer an observation of his, in his work on the particular nature of animals, (B. i, c. 55,) to any other than the Basking Shark; the occurrence of which in the Mediterranean Sea appears to be intimated by the French writer Pomet, to whom we shall have occasion to refer again. Ælian says that there are three sorts of sea-dogs, the largest of which might be reckoned a Whale of the largest size. The other two are very much smaller, and are the Centrine and Galeus. Lacepede doubted whether the White Shark does not reach an equal size; but there is no account of the latter fish as attaining anything like the length of thirty-six feet, which was the case with the example of Basking Shark seen at Brighton by Mr. Yarrell. One was taken in Cornwall that measured thirty-one feet eight inches, from which our figure was taken; and the circumference of body great even in proportion to such enormous length. Lacepede speaks of one that measured thirty-three feet in length, and twenty-four feet in circumference.

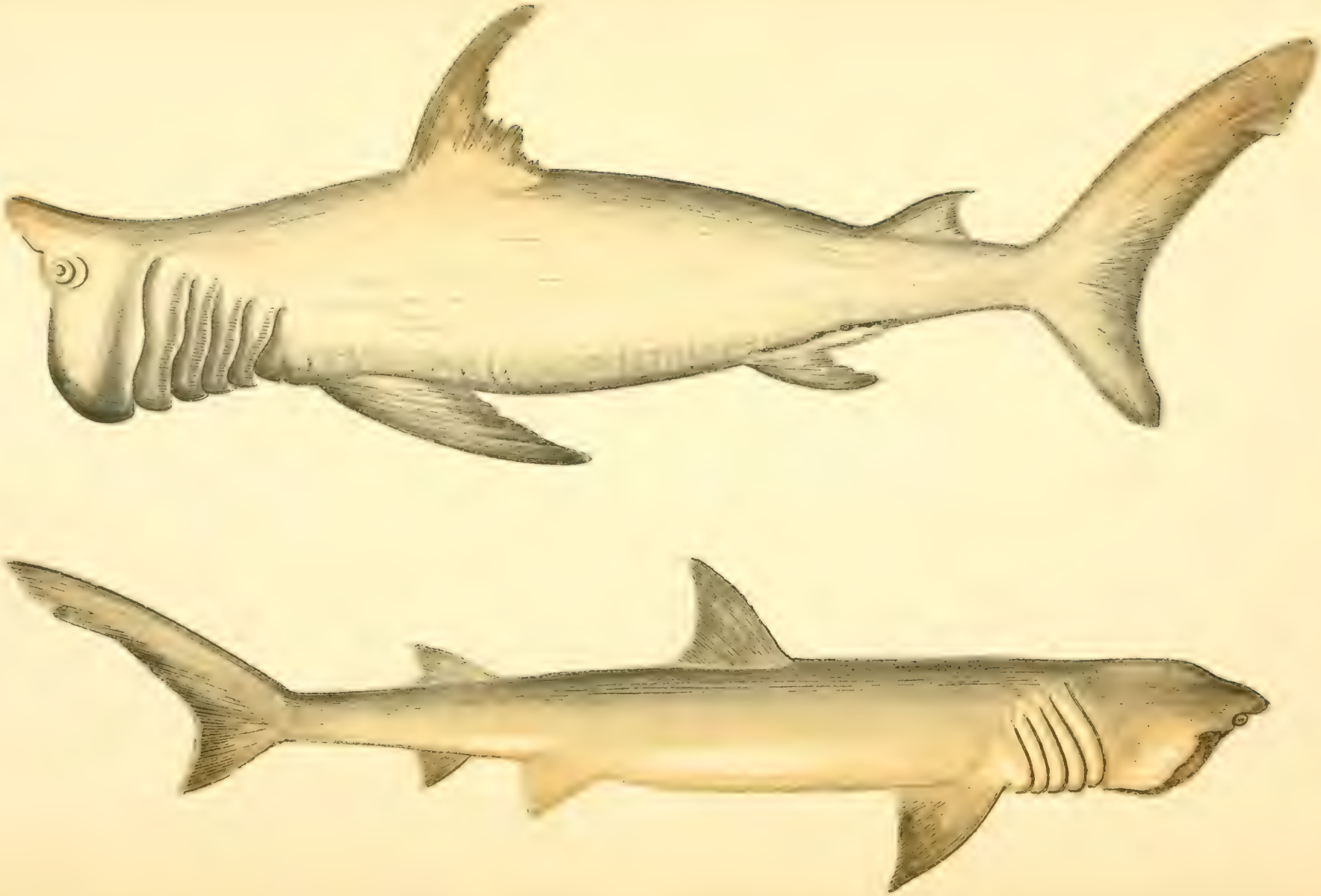
We are not to place credit, however, in Baron Haller's assertion, that cartilaginous fishes are ever growing, and find no limit to their size, ("First Lines of Physiology," 8vo, Edin., p. 463;) for some species are never other than small, and others at first starting into existence are of considerable size, and yet are never met with above a certain bulk. The example par-

ticularly referred to was thirty-one feet and about eight inches, nineteen feet round, and the mouth was five feet and a half wide; extent of the tail six feet nine inches; the weight said to be eight tons. As it lay on the ground the height of the body was eight feet and a half. The skin rough; eyes small; spiracles between the eyes and upper portion of the gill openings; upper jaw longest, but not greatly protruded; the teeth about an inch long, blunt at the top, and but slightly compressed; the body rising behind the eyes; a strong ridge at the sides near the tail; a depression above and below at the root of the tail. Pectorals rather long, and ending in a point. The first dorsal about midway between the ventrals and pectorals, and wide and high; the second dorsal about midway between the ventral fins and anal, smaller than the first dorsal, but larger than the anal. Colour, dark on the back, but in some examples it is described as blue, lighter on the sides, and white below. Fleming says the liver of a full-sized fish yields from eight to twelve barrels of oil; and that of the Cornish specimen, above referred to, produced one hundred and ninety-eight gallons; two examples, of about thirty feet, at Broadhaven, in Scotland, yielded almost nineteen barrels, of which eight make a ton.



TEETH, ETC., OF GREENLAND SHARK.

1.—Single tooth.
2.—Under jaw, outside view.
3.—Under jaw, inside view.
4.—Eye, with parasite attached to it.



1. RASHLEIGH SHARK. 2. BROAD-HEADED GAZER.

POLYPROSOPUS.

This is a new genus, denoted by a word which is intended to represent the manifold aspect, which forms the chief character of the species intended to be comprised within it.

It may be objected to this arrangement that the species referred to are not sufficiently known or described to warrant the formation of a new genus for their reception. But to this the reply is offered, that although many particulars regarding them, that are to be desired, are unknown, this should not be held sufficient to prevent us from making a record of what we have been able to collect, and which thus will be preserved for the use of future naturalists; whose opportunities, although partial like our own, may, in some time to come, enable them to supply materials in which we have the misfortune to be deficient. The value of even imperfect records has been proved in some other instances, and after the lapse of many years.

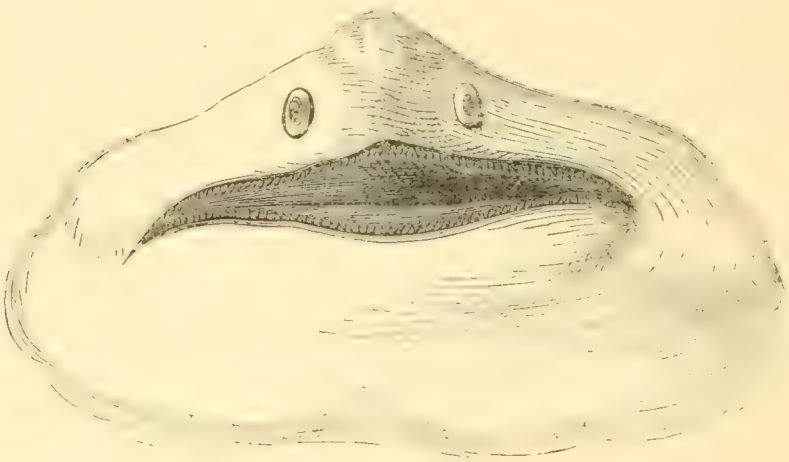
The characters on which our proposed genus is founded are:—a short projecting snout, with a broad mouth; the eyes looking forward in front, so that, contrary to the habits of other Sharks, they are able to gaze with both eyes on an object directly before them. Gill openings very large, and encompassing the neck, as in the genus Selachè. These characters are so well marked that I have not thought it necessary to take notice of the anal fin, which exists in the figure of one of the species, and is absent in the other.

RASHLEIGH SHARK.

Squalus Rashleighanus,	Transactions of the Linnean Society, vol. xiv, p. 91; Cornish Fauna, vol. i, p. 51.
Polyprosopus Rashleighanus,	Nobis.

There is little doubt but that this s one of two or three fishes which have been confounded with the Basking Shark, to which its large size must have greatly contributed. The figure, with a few particulars concerning it, were presented to me by William Rashleigh, Esq., of Menabilly, in Cornwall, himself a competent naturalist, and in whose honour the name is affixed to it. This example was obtained in St. Austle Bay, near his residence, but in what manner I am not prepared to say.

The fish is described as being twenty-nine feet four inches in length, and twenty-four feet round; the fork of the tail seven feet; the weight four tons; the mouth two feet and a half wide. In the drawing the eyes are in front, and the vision directed forward; the snout rather small, narrow, and turned up; but it is probable that this had been caused by the manner in which the heavy body had lain, and consequently did not shew the natural form. The head deep, and full on the cheek; orifices of the gills wide, and passing high on the sides. The first dorsal fin is elevated, and near the head; second dorsal far behind; the pectorals long and pointed; no anal fin; nor any appearance of a ridge on the side near the tail.



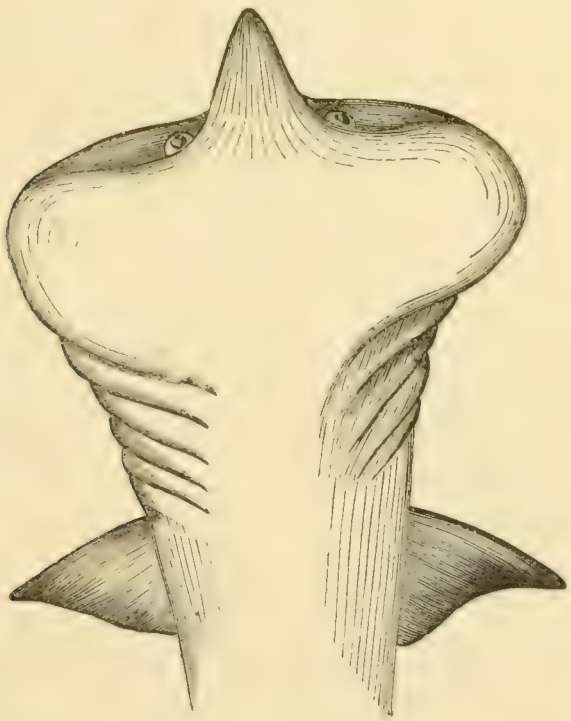
HEAD OF RASHLEIGH SHARK.

BROAD-HEADED GAZER.

Polyprosopus macer, NOBIS.

THIS fish was caught in a mackerel net off the Startpoint, in the last week of March, 1852, and was brought to Plymouth, where it was exhibited publicly as a great rarity; and from which the following unfortunately slight sketch and description were taken, the former by a gentleman of the Royal Navy,

and the latter by a curious but scarcely well-informed individual:—The fish measured sixteen feet seven inches in length, and its general proportions were nearly those of the Common Toper; the tail also as in that fish; no ridge at the hinder part of the body near the tail; skin not rougher than in the generality of Sharks. The snout sharp and projecting; eyes looking forward; flattish over the head, with a little rising, and, as in the figure, singularly widened at that part. The teeth flat, exactly as in the Thornback Ray or Ray-mouthed Dogfish. The gill openings five in number, encompassing the throat to the back, and before them a doubling or plaiting of the skin, which appeared like another opening. Pectoral fins not quite so long in proportion to its size as in the Blue Shark. The anterior dorsal fin anterior to the ventrals; the second and anal opposite each other. No spiracle was observed; the colour approaching to brown, lighter on the belly. A female. Girth at the pectoral fins five feet ten inches; width across the head three feet six inches; length of the snout before the eye ten inches; extent of the tail four feet. The liver yielded twelve gallons of oil.



HEAD OF BROAD-HEADED GAZER.—UPPER SIDE.

ZYGÆNA.

The form of the head extended sideways, with the eyes at the extremity of the lateral extension, and the nostrils on the anterior edge of it.

HAMMER-HEAD.

BALANCE FISH.

Squalus Zygæna,	Linnæus.
Zygæna malleus,	Cuvier. Jonston; Punctum 7, tab. 78, but he is mostly a copyist.
" "	Willoughby; p. 55, tab. B 1.
Squale marteau,	Lacepede. Risso. Bloch; pl. 117.
" "	Lowe; Fishes of Madeira, tab. 12.
" "	Jenyns; Manual, p. 507.
" "	Yarrell; British Fishes, 2nd. edition, vol. ii, p. 504. I am informed that the figure which Mr. Yarrell gave in his first edition, p. 406, is that which has been called *Z. Blochii,* and which is the fœtal condition of *Z. laticeps.* This figure is omitted in his second edition.

The ancient Greek writers were acquainted with this fish, which they called Zygæna, or the Balance, from the form of its head. But it is not named by Pliny, the general copyist of the Greeks, although it finds a place in the writings of Oppian and Ælian, who however only or chiefly regard it as

> The monstrous Balance Fish of ugly shape.

Oppian only goes a little further, by a pardonable exaggeration, to compare it with the lion:—

> But what's the lion! sharper weapons arm
> The Balance Fish, and keener furies warm;

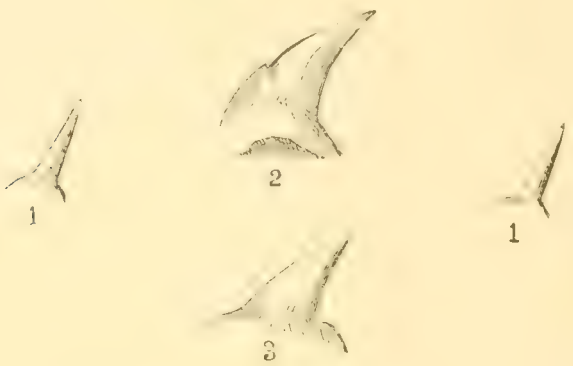
to which Ælian adds the great danger to which sailors are exposed by it, (B. ix, c. 49;) to all of which Lacepede unites his testimony, with such additional horrors, however, as must cause his readers to feel surprise when they read the adventurous voyages of sailors in every variety of climate, without finding the mention of this fish or of any injuries they have suffered from it.

That it is an eager, daring, and savage fish may be granted; but the limited size of its mouth forbids the mighty grasp which the White or Blue Sharks would take of an object; and it seems probable that the nature of its food is not of that indiscriminate kind as theirs is known to be.

The Hammer-head is a rare wanderer to our seas; and only a few examples are on record of its occurrence in the British Islands; which, therefore, are probably the most northern limit of its range. Besides the one hereafter mentioned, and of which the skeleton is preserved in the Museum of Natural History at Penzance, another was taken at Yarmouth, in the year 1829, and a third at Tenby, in Wales, both mentioned by Mr. Yarrell, and the latter also by L. W. Dillwyn, Esq., in his "Fauna of Swansea." This last example was a female, and in August was found to contain thirty-nine young ones ready for exclusion. Mr. Lowe found this fish in Madeira; and Risso says it is not uncommon in the Mediterranean from July to September.

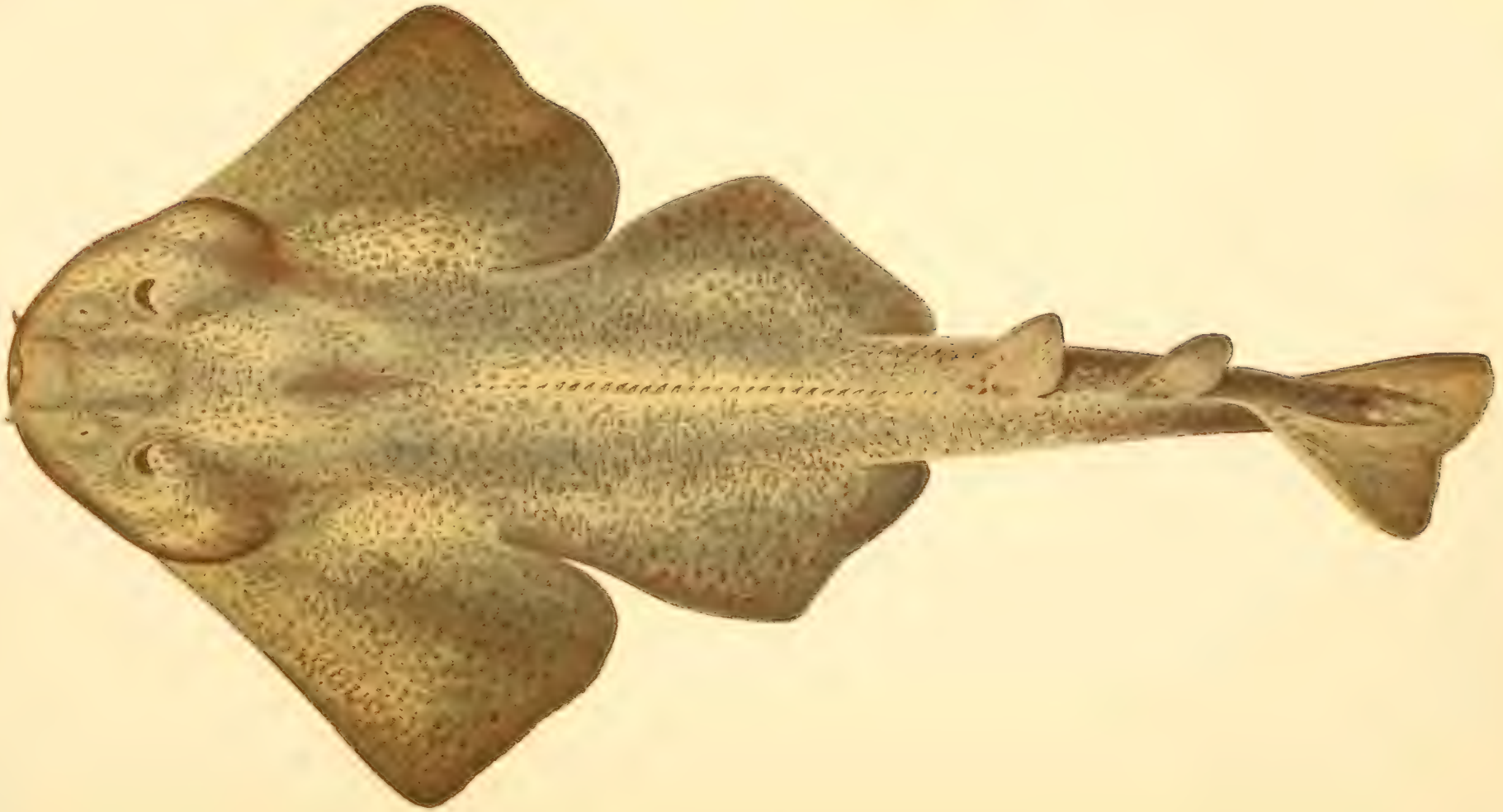
In the month of November, 1834, some fishermen of Newlyn, in Cornwall, on hauling their nets, found a large fish entangled in them, and almost dead. It proved to be the Hammer-head, or Balance Shark; and from the notes derived from this source, and from another of smaller size, not a British specimen, and but poorly preserved, the following description of this species is derived:—The length of the newly-captured example was an inch less than ten feet; girth of the body three feet seven inches; the head slightly festooned in front, flat, and in breadth three feet; an eye at each extremity of the expansion as large as that of an ox. The nostrils at the anterior edge of the expansion, not far from the eyes. A remarkable bone lies across this expansion of the head, being an elongation of the orbital processes of the skull. The mouth in shape like a horse-shoe, with three rows of teeth in the upper jaw, and

two in the lower; the teeth sharp, the points inclined towards the angle of the mouth, and serrated below on the concave edge. The first dorsal fin sixteen inches long, but a little way behind the pectorals. Pectoral eighteen inches long. The second dorsal and anal opposite each other, and far behind; both dorsals and anal lengthened out posteriorly; a depression at the upper root of the tail. Upper lobe of the tail three feet long, under lobe sixteen inches. The colour brown on the back, lighter below.



TEETH OF HAMMER-HEAD.

1.—Front teeth. 2.—Side tooth above. 3.—Side tooth below



MONKFISH.

XVII

SQUATINA.

The body depressed, tapering to the tail, and more rounded posteriorly. The head separated from the expanded pectoral fins by a neck; mouth terminal; eyes on the upper surface. Dorsal fins separate from the caudal, which is placed at the end of the body.

MONKFISH.

ANGEL-FISH. LEWIS. SHARK RAY. KINGSTON.
MONGREL SKATE. PUPPY-FISH.

The pectoral fins have been supposed to resemble wings, from which it has received the name of Angel Fish; it is also called Monk, because this structure has caused it to resemble the cowl worn by that class of religionists.

Squalus Squatina,	Linnæus. Donovan, pl. 17.
" "	Bloch's Plates, 116, from a dried skin.
Squatina Angelus,	Cuvier. Jenyns; Manual, p. 507.
" "	Yarrell; Br. Fishes, vol. ii, p. 539.
Squatina et Angelus marinus,	Jonston, p. 49.
" " "	Willoughby, p. 79, Tab. D. 3.
Squale Ange,	Lacepede.
Squatina Ange,	Risso. Fleming; Br. An., p. 169.
Squatina vulgaris,	Gray; Catalogue of Br. Museum, p. 133.
" "	Swainson; Natural History of Fishes, etc., vol. i, p. 185.

The Monk is a common fish in the western parts of the kingdom, but it becomes more rare as we proceed to the north, although it has been taken so far in that direction as the Orkney Islands. It keeps near the ground, and rarely rises high in the water in pursuit of prey, although it appears to be eager in the search. Yet it is less frequently taken with a line than many other fishes, which circumstance can

only be explained by its being more select in its appetite for food. One which measured four feet six inches in length, had in its stomach twenty-eight opercula, or head-covers of whelks, without the shells, which latter had been thrown up from the stomach, as the Sharks and Skates are known to do with whatever indigestible materials they occasionally swallow. And besides these remains of what appears to have been a favourite food, there were also fragments of small fishes, and two stones about the size of nutmegs, which probably had been taken in consequence of having been covered with some sorts of encrusting corals, and would have also been thrown up from the stomach in their turn.

Oppian says that it produces young twice in the year, by which he may be understood to mean no more than that some of them are found in a fertile condition at opposite seasons. I have found the eggs as large as walnuts in May, and the young, usually to about twenty, to be expelled all at once in July, on the instant when the pregnant fish was taken into the boat. Risso mentions the same thing, and ascribes the sudden parturition to faintness produced by the cessation of the action of the gills, but more probably it proceeds from the alarm of capture. These young ones are about a foot in length, and closely resemble the parent fish, even to the roughness of the skin and spines, with teeth also in the jaws.

The ancients believed that this fish had an affection for its young similar to that displayed by the Blue Shark and some others of that race; according to a maxim which they regarded as universal, that it was the property of every creature which produces its young alive, to manifest love for their preservation. In the present instance, in the prospect of danger they supposed it shewn by affording them shelter in the depression between the head and pectoral fins.

The skin of this fish was anciently of much use in the arts, being of that particular degree of roughness which fitted it for polishing ivory and wood; on which account the fish was called by the Greeks Rhinè, or the file.

It is disregarded as food in the present day, but in ancient times it was otherwise. Paulus Ægineta, a physician of Greece, speaking of cartilaginous fishes, says:—"The Torpedo and Fireflair have soft and sweet flesh, which is easily digested;

but Skates, the Monk, and others of that family are harder, and afford nourishment of a stronger kind."—B. 1, C. 93.

Lacepede describes this fish as attaining the length of seven or eight feet, and Rondeletius had seen it about the length of a man, and weighing one hundred and sixty pounds; but with us commonly measures from four to five feet, with a breadth at the pectoral fins considerably exceeding half the length. The general figure of the body is much depressed, but most so anterior to the termination of the ventral fins. The head flat and round; mouth terminal, with rows of short, sharp, hooked teeth in lengthened order, and intervals between the rows; nostrils at the border of the head, near the mouth, and having a short loose process projecting from it. Eyes small, separate, on the top of the head, all but the pupil covered with the common skin. Spiracles large, half-moon-shaped, their convevity forward,—considerably behind the eyes. Gill openings five, on the lower surface. The pectoral fins widely spread, encompassing the sides of the head without being united to it; the ventrals larger than in any known Sharks or Rays. The skin rough all over the upper surface; a row of spines down the back to the first dorsal fin; a half circle of them behind each side, and also, in some examples, along the anterior margin of the pectorals, as well as of the dorsal fins and tail. Dorsal fins two, on the more slender part of the body, behind the ventrals. The tail irregular, and the lower half more extended than the upper. Colour sandy grey, speckled above, white below. In young examples, which are often mottled with yellow or green, there is sometimes a white line extending across the shoulders. I have seen a full-grown example without the usual line of spines along the back.

In the anatomical structure of this fish the pectoral fins are much like what we shall find in the Skates, but the jointed rays do not proceed so close to the margin of the side; but stop short, and serve as the basis of pencils of smaller fibres, as do the ventrals also. On minute dissection it has been found to possess ears, of simple structure, such as Monro detected also in the Common Skate, *Raia batis;* and on the top of its short and rounded head there is the fontanel or opening where the brain is covered only with the firm skin, as in the

Sharks and Skates, thus affording an example, in addition to the cartilaginous condition of the bone itself, of apparent conformity with the earlier stage of existence of mammalian animals; and which some writers have thought proper to regard as a defect, or at least an inferior state of development; but which, as we have already shewn on the authority of Mr. Owen, when we spoke of the Sharks in general, beyond doubt answers an important use in the natural œconomy of this great family of animals. We remark it more especially in this species because it is not merely an unclosed opening in the skull, but a well-organized opening of definite formation. It becomes a question whether, by endosmodic action penetrating through the membrane, this is not the passage through which the water so abundantly found in the cavity of the skull and spinal column finds admittance, as we see it existing there in all the species of Sharks and Skates.

It has been remarked in the general description of the fish, as a character in which it stands alone, that it is deficient in that projection of the skull which is so distinguishing a mark of its kindred families of Sharks and Rays; but the deficiency itself affords an advantage which the others do not possess,—of being furnished with such a protractile upper jaw as is capable of extensive motion, especially in an upward direction, corresponding with that of the head itself, in relationship with the vertebral column. This vertebral column, or back-bone, which possesses about one hundred and twenty separate joints, as in the generality of Sharks, is flexible in all its extent, none of the bones of which it consists being inseparately united together, as they are in the uppermost part of their course in Skates; and at the tail they assume a course seemingly at variance with that of their race in general, by passing to their termination on the border of the lower rather than of the upper lobe of the caudal fin. The organization which seems equivalent to spinous processes of the vertebræ, that stand up to support the dorsal fins, are in fact broad plates, each of which involves at least two of the vertebræ, and thus they afford the fins a more than usually firm support. In these particulars of structure, as well as in the outward form, we discern a partaking of much of the character of the sub-families of Sharks and Skates, coupled with a departure from both in

some circumstances, which, if they point out affinity to any other race, at least do not so to any with which we are acquainted.

In one particular also the eyes deserve to be mentioned. They do not possess a nictitant membrane, as in some Sharks, nor a fimbriant veil, as in the Skates, but the common skin of the body passes over the globe, and is capable of shutting up the pupil in the manner and with the effect of an eyelid, although without a fold, a slight slit remaining lengthwise as a pupil.

1.—Pectoral Fin of the Monkfish—under side.
2.—Abdominal Fin—under side.
3.—Teeth, portion of under jaw.

SKATES.

The distinguishing marks of this family as compared with the Sharks, are a general depression and flatness of the body, with a large expansion of the pectoral and ventral fins; the former being united to and encompassing the head, so that together they form a disc, which is either rounded or of a rhomb-like form, with the angles slightly marked; a structure that displays a remarkable adaptation to the peculiar habits of this tribe. The snout in most of the species projects, and in all the mouth and nostrils are under the head, the latter being united to the former by a superficial channel, or deep fold in the skin. The gill openings are five in number, as in the Sharks, but they are placed on the under surface; and on the head, not far behind the eyes, are the spiracles or temporal orifices, which, when they exist in the Sharks, are generally small, but in this family they are large and open, although capable of being closed at the will of the creature; and their use is more apparent in the present class; for as it is their habit to lie flat on the ground, it becomes necessary that they should be furnished with an apparatus sufficient to give passage to a full supply of water to the gills for the purpose of breathing; at a time when the mouth must for a long time remain shut, and the current from that direction consequently be interrupted, even if it ever exist. That this supply of water needs to be large and constantly repeated, may be judged from what Monro describes of the extensive capacity of the interior structure of the gills, the superficial extent of which he estimates as amounting to almost the whole external surface of the human body. Thus, says he, in each side of the body of a Skate there are four double gills, or gills with two sides each, and one single gill, on which the branchial artery (which brings the blood for purification) is spread out. On each of these sides there are about fifty

divisions or doublings of the membrane of the gills. Each division has on each side of it one hundred and sixty subdivisions or folds of its membrane, the length of each of which in a very large Skate is about one eighth of an inch, and its breadth about one sixteenth of an inch; so that in the whole gills there are one hundred and forty-four thousand folds, the two sides of each of which are equal to the sixty-fourth part of a square inch, or the surface of the whole gills is equal to two thousand two hundred and fifty square inches, that is, to more than fifteen square feet, which have been supposed equal to the whole external surface of the human body. When, after a good injection by an artificial coloured fluid of the artery, a microscope is applied, the whole extent of the membrane of the gills is seen covered with a beautiful network of exceedingly minute vessels.—(Monro, "Structure and Physiology of Fishes," p. 15.) Those particulars are given the more at length because they belong to the whole of this large family of Sharks and Skates, although perhaps to some of them in a less degree. And, indeed, they are applicable to fishes in general, although in a still less degree in the class termed the bony fishes, in which the water is made to travel through the gills in a more rapid manner, to make amends for the less extent of surface to which it is applied.

The blood is brought to this purifying apparatus by a vessel proceeding from a heart specially framed to be a powerful instrument of propulsion; for although the general cause of the circulation of the blood is formed on the same principle in all fishes, the peculiarity of action and the power varies considerably, as regards the present genus, compared with several others. In Sharks and Skates the heart is of a singularly complex structure, mingled with simplicity; the organs of the great artery, or vessel which bears the blood from the heart to the gills, consisting of a long muscular tube, which may be regarded as an extension of the heart itself, and which tends greatly to aid its powers of action; but a remarkable circumstance attending it is the degree of which physiologists call irritability that resides in it, and which maintains its powers of life and action under circumstances which to other races must speedily prove fatal. I have even

seen the heart of the Common Skate wounded and cut from the body, and afterwards it has continued to beat for almost a whole day; and even when pulsating action has ceased it has again been made to resume its motion on the infliction of an additional stimulus. Nor is this power of retaining vitality confined to the heart, or to a single species of this family, although it may be more persistent in some than in others. I have given instances in the Blue Shark of the little present influence had on that fish by what at last cannot have failed to prove fatal injuries, and I shall adduce others not less surprising when we treat of the history of the Common Skate; but in every case it has its source in the same cause—the possession of a large degree of independent vital power in each organ of the body.

Monro, in the work already quoted, has shewn that there exists in this class of fishes, or at least in the Common Skate, as well as in the Monkfish, a well-developed apparatus for the faculty of hearing, the presence of which appears to imply a power of intelligence for which we could scarcely have given them credit; but the most remarkable of the organs of sense are the eyes, which are more elaborately organized than even in the Sharks, and which therefore are well calculated to render these fishes effectual service in their situation close to the ground. They are placed on the top of the head, not very close to each other, with the vision neither directed upwards nor forwards, but sidewise, and they are protected as well, by generally a row of spines behind them, as by a firm structure of cartilage on the upper part of the globe itself. This globe is supported on the base of the ocular cavity by a pillar not unlike that already mentioned as existing in Sharks; but, in addition to this, the cornea or clear portion of the organ is furnished with a veil, which hangs from the uppor border of the iris, and in a large degree covers the pupil, and is capable of doing so entirely. The ordinary opinion among naturalists concerning this curtain is, that it is of use in enlarging or diminishing the opening of the pupil, according to the degree of light that is poured on the nerve of sight, as the fish may be exposed to its influence by rising or falling in the water. But I feel disposed to believe that this is not the only nor even the principal use of this beautiful piece of workmanship, of which

I give a figure as taken from the eye of the Common Skate. It will be seen to possess a fimbriated border, and is coloured within and without, although all besides within the chamber is black. This curtain may be influenced by the appetites or passions of the creature, although it is not subject to the influence of the will. It is too near the lens to be brought into its focus, but it is the nature of a fringe like this to hinder the definition or formation of a border to the picture painted on the visual nerve; thus producing an effect similar to that caused by an instrument lately invented by photographers, and placed by

them in front of the object-glass or lens of the camera, to give what they term a vignette appearance to their pictures. An object looked at by the fish becomes by this structure better defined, because its attention is not permitted to be limited by any margin that would appear from a border shaped by a more simple iris.

An able anatomist might not encounter insuperable difficulty in pointing out in the principal bones of the pectoral fins of this class of fishes, what bears an analogy to the arm and hand of a human being, of which that portion answering to the thumb is extended forward to find support in a protuberance at the side of the head. From these bones proceed a multitude of flexible and jointed rays, which constitute the expansion of the pectoral fin, and at the same time provide for its freedom of action. These rays divide and sub-divide as they are spread out, and in the Common Thornback Ray amount to eighty-two in number, having in them twenty rows of joints; but I have seen them ossified, and thus made like the bones of the classes termed osseous fishes, in which instance their minute structure appeared beautifully radiated.

It is the character of this family to have the ventral fins arranged on a level with and as a continuation of the pecto-

rals; and the combined use of both is to raise the body from its usual prone position on the ground, and to sustain it in a floating posture, but without much power of propulsion. To the ventrals, on their inner side in the males the claspers are attached, which are usually much longer and stouter than in Sharks, and which, by a complex system of joints, admit of great variety of motion.

As there is less need of flexibility in the body of this class of fishes than in the kindred family of Sharks, several of the vertebræ or jointed bones of the back, near the head, are consolidated into one, by which the stability of that part is rendered secure; but if any deficiency of motion could arise from this cause it is abundantly compensated for by the flexibility of the tail, which has no caudal plates or processes to stand in the way, and which therefore is capable of action in every direction. It is therefore not only effective in driving onward or steering the body, but also as a weapon of defence; for being generally armed with rows of formidable spines, it is capable of inflicting severe lacerations on any creature that comes within its reach. Aided by the pectoral fins, which, especially in the males, are also well furnished with these crooked spines, they are indeed weapons to be dreaded, and the species supplied with them appear to be well acquainted with their use. This instinctive faculty of knowledge is indeed a wonderful portion of the history of animals, even of those that are apparently most dull and stupid, and has been noticed by observers of ancient as well as modern times. Oppian, in his imperfect poem, the "Halieuticon," observes,—

"To all is given
To know the power and nature of the dart."

In self-defence not only will the Torpedo discharge its electric shock, and the Fireflair direct its formidable spear, but the Common Skate will bend its pectoral fins into a concave form to encircle the object, and then cause them to draw back that the beds of spines may rasp the body of its enemy; whilst the still more formidable tail is brandished over all in a manner that few creatures are fitted to withstand.

In the young of the generality of this order, as they

proceed from the egg-case, this more slender portion of the body is proportionately of much greater length than in the full-grown animal; but by a process not much unlike that which deprives the tadpole altogether of its tail, the end that lies behind the dorsal fins gradually ceases to receive nourishment, and consequently diminishes, so that by the time the fish has attained to about a fourth part of its full dimensions this part is reduced to a much less lengthened condition. In the generality of these fishes there are on this part only two small dorsal fins, but there is more obscurely a slight border of membrane along the sides, and a rudiment that almost resembles a fin which proceeds from the second dorsal to the end. There has also in a very few instances been discovered an elevation of membrane resembling a fin, on the body or disc itself, in one or other of this family; and the circumstance has been deemed of sufficient importance to warrant a belief in the observer that it marked the existence of a distinct species. The first notice of it was by Cuvier, who, however, appears to have doubted whether it was anything beyond an accidental variety of a common species. But Lacepede felt no doubt on the subject, and in his "History of Fishes" he gives a figure and description of it under the name of Cuvier's Ray. It has since been detected in Scotland, and as a mark of a species is adopted by Dr. Fleming, under the same name; but it appears to be at this time the common opinion of naturalists that Cuvier's suspicion was well founded, and that this supposed fin is nothing more than a doubling of the surface of the skin of the back, and is not a sufficient mark that the fish bearing it was a distinct species. It is among what we denominate the aberrant genera of this family that in some cases the true tail exists, in addition to the dorsal fins, and in others no fins of any sort are found. We shall notice those more particularly when we speak of the different genera.

So far as is known, and at least among all the members of this family found in the British Islands, all of these fishes produce their young from eggs enclosed in purses; which eggs descend from the ovarian receptacle in pairs, and become excluded in succession, in seasons of the year appropriate to each species. These purses are formed of a leather-like substance, with in general short but rather firm tendrils at the

corners; and the only use of these tendrils seems to be by meeting in an arch to open the way for the free passage of the case itself in the process of exclusion. They appear to be cast at random, with little attention to security, and, in consequence, when the parent fish reside in shallow water they are frequently washed on shore by the turbulence of the waves. They are safe, however, from the devourers of the deep, for I have never found them in the stomachs of fishes.

There seems to be some grounds for doubt as regards the etymology and meaning of the names of Skate and Ray; of which the former have been sought in the Latin word *Squatina*, which, however, has never been applied to any of the fishes known to us by the name of Skate. The name of Ray is equally uncertain, and although it is employed by Pliny to signify some fish of probably this genus, it is not referred to any known root in the Latin language; and in Greek, from which its meaning is more probably to be sought, it was not known as applied to any known species. If at all derived from that language, the explanation of an author (Hermolaus) quoted in Stevens' "Thesaurus," affords the only interpretation we are able to assign to it. It obtained its name, says he, from the likeness of its spines to a bramble, which the Greeks called *Batos*, because it has sharp hooks on its back. The *Pastinaca* has the like, but besides this the latter has a very dreadful and poisonous dart. There is also a larger Ray, which the Latins called a Smooth Ray, and the Greeks *(Liobatos)* by a word of the same meaning, but which has no crooked spines. The word Ray of course is to be supposed a translation of the original meaning of *Batos*. This etymology appears sufficiently far-fetched, and it should not be forgotten that as far as regards the English names of these fishes, the Saxon language affords a more plausible derivation; and I give it the rather that I have thus an opportunity of explaining some circumstances connected with the English fisheries, which may be considered as a portion of the history of those species.

An adventure in the fisheries, at least in the West of England, is usually set on foot by some practical fisherman, who provides the boat and her outfit, and who himself acts as the principal fisherman; and who seeks his profit as owner

by what is called the boat share, which commonly amounts to a fifth part of the fish sold in the market: for the remainder he has a common share with his men. But other fishes will come to the hook besides those which find a place at fashionable tables, or the public are accustomed to buy, and which, indeed, are intrinsically as valuable as any which have a ready sale. The Grey Gurnard, Scad, Comber, Power, the Wrasses, Dogfish, Rays, and Skates, are in this class, and by the fishermen they are collectively known by the name of rabble-fish, as being rejected from the market; and they consequently fall to the lot of the fishermen themselves, who take them for the subsistence of their families, without deducting any portion for boat share. The Skate is the largest, and, on the whole, the most important of these rejected fishes, and the Saxon word *Skitan*, to reject, is expressive of the fact of its being so. The same word is the parent of several expressions still in common use, as significant of being thrown out, aside, or rejected; such as to *scout* an opinion, a *scout* thrown out from an army to obtain intelligence, and *scatter*, to disperse widely abroad. In the West of England a *skit* is a lampoon thrown out at random against anyone who make choose to take it up. Ray may be derived from the word *reoh*, which signifies rough, and is indeed the ancient form of that word. In its simple form it is applied to the Common Thornback, which is the most valued of the tribe.

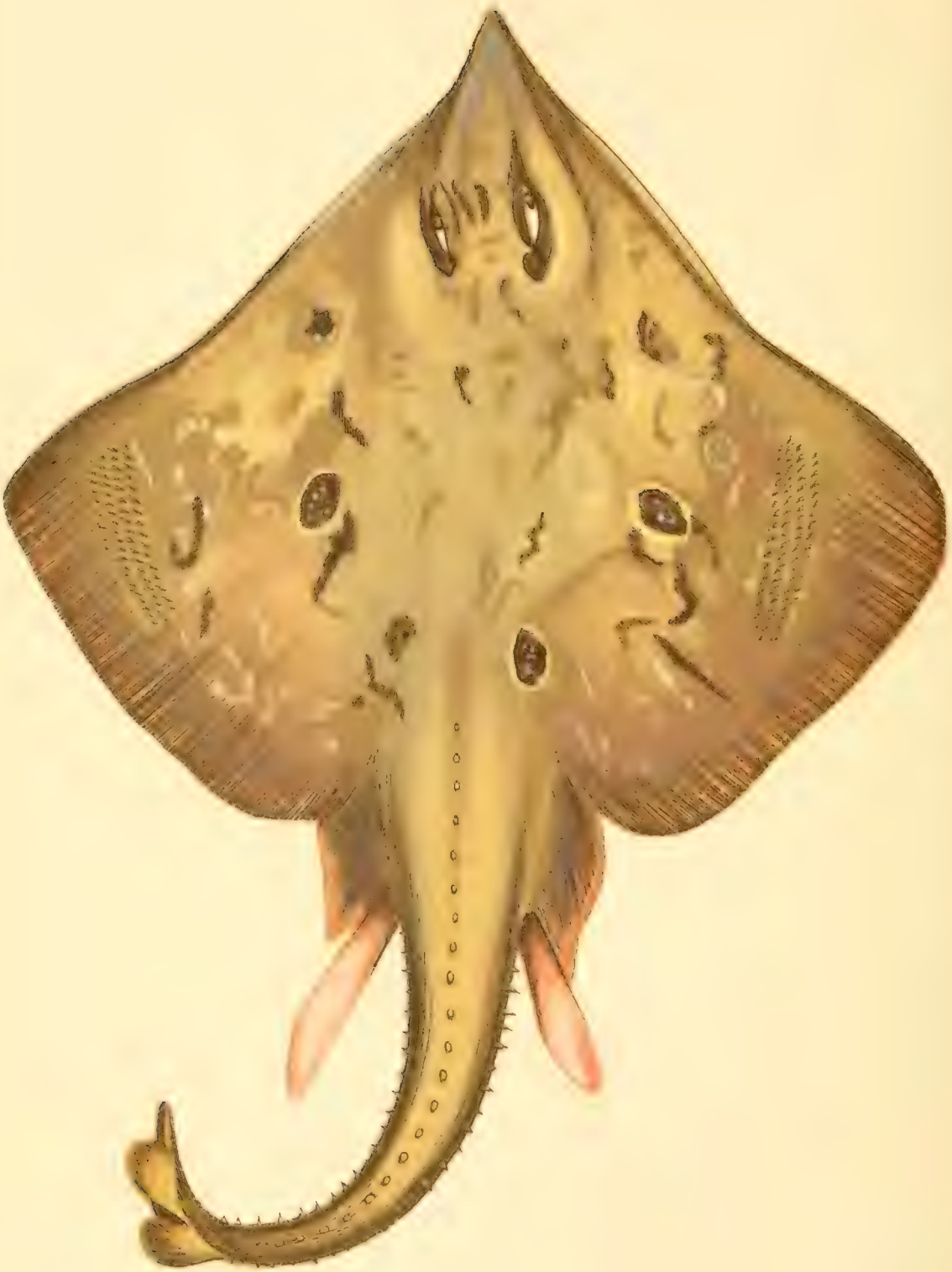
RAIA.

SKATES AND RAYS.

The disc approaching to the figure of a rhomb; the tail slender, and furnished near its termination with two rounded dorsal fins; the jaws crowded with teeth.

SKATES.

When the number of species in a recognised genus is considerable, it has been found convenient to divide them into groups, according to some distinguishing marks, which are perhaps of less importance than can be regarded as necessary to constitute a generic distinction, and yet in which a certain number of those marks come together with the absence of others. This has in fact been a leading principle in the arrangements made by some eminent naturalists, and it is according to it that I would make a separation in the Cuvierian genus *Raia*, by which the Skates, properly so called, will be kept distinct from those which are in common language more properly called Rays. Among fishermen they are for the most part so distinguished on account of the greater size, but the fact of magnitude would be attended by too much uncertainty to be a proper mark of distinction, and it is on other accounts unnatural. A better, because a more decided and permanent mark is the colour of the under part of the body, which in the proper Skates is dusky, arising from a large number of ducts and pores, that appear through the skin in lines, and cause it to appear of a dark grey tint. Their use is to pour out mucus or slime, which renders the surface of the body soft and slippery, and tends no doubt to their safety and comfort. In the proper Rays pores of a like kind also exist, and the slime poured out is abundant; in which they differ from their congeners the Sharks, for in them the pores are not rendered visible by their colour, and the colour of their under surface is in consequence pure white. I therefore distinguish the former division, which comprises the Skates, as a genus, under the ancient name of *Batis;* and which will be sufficiently distinguished by joining to the characters of *Raia*, already given, the addition, that the under surface is covered with dusky lines and spots.



SKATE.

FLAIR. BLUE SKATE. GREY SKATE. TINKER.

Batis vulgaris,	Nobis.
Rasa Batis,	Linnæus. Cuvier.
Lævis undulata, seu cinerea,	
Skate, or Flair,	Willoughby; p. 69, tab. C. 5, from a dry skin.
" "	Bloch; pl. 79.
La Raia Batis,	Lacepede.
Raia Batis,	Risso. Fleming; Br. Animals, p. 171.
" "	Jenyns; Manual, p. 510.
" "	Yarrell; Br. Fishes, vol. ii, p. 561.

The Skate is one of our commonest fishes, and is found on all the coasts of the British Islands, although it becomes less abundant as we proceed towards the north. By its flattened form it is well fitted for a residence at the bottom, where it is usually met with on a soft or sandy ground at a good distance from land; and from which it does not often rise in the water, its emotions when aloft being with evident effort, by means chiefly of the pectoral fins, whilst the tail and dorsal fins are rather employed in directing its course than in urging it onward. Judging from the size of its nerves of sensation,—as well of feeling, as of smell and taste, and, it would appear, of hearing also,—it is a fish of quick impressions; and accordingly it is reported by fishermen to shew considerable choice in the selection of its food, and from my own enquiry, much skill in supplying its appetites. Sir John Dalyell found that a young Skate which he kept in captivity would not feed on anything but Whitings, and fishermen are aware that they catch them in much larger numbers when they bait their hooks with pilchards or herrings. But although from what would appear to be the unfavourable situation of its mouth and eyes, it might be supposed to find a difficulty in satisfying the cravings of an eager appetite, it yet evidently possesses powers that make up for whatever exists of disadvantage. On examination of the stomachs of

several examples, I have found in one a fishing frog, or angler, that weighed upwards of six pounds; in another two large plaice; a lobster; a couple of mackerel; a thornback ray, about eighteen inches in length; and half a salmon, the piece appearing fresh, as if but lately devoured.

Bloch informs us that at the breeding-season, which is in summer, each female is followed by several males, and that the latter attach themselves so closely by the claspers, that the capture of the former will often secure that of the latter. The egg is contained in a purse, four or five inches long, of a texture like leather, and oblong shape, with a short and slender tendril at each corner, flexible like leather, and brown, and with, at first, separate fibres that are easily peeled off. They are shed in pairs, at apparently short intervals, without being attached to any fixed body; but on one occasion an intelligent fisherman reported to me a remarkable departure from the usual course of proceeding, arising, it cannot be doubted, from some abnormal structure or action in the parent fish. On cutting open a fish of unusually large size, he was surprised to find in the receptive organ a pair of young ones, which were nearly twice the size of such as have been newly excluded from the purse; and they appeared perfect in all their parts, except that the eyes seemed to be obscure. Aware of the extraordinary nature of the occurrence, he sought further, when he discovered the purses also, enclosed in the same organ, but in a very decayed condition. It is clear that in this instance we have an example of internal hatching of the egg, but without the power of excluding it into life.

The instances that have been given of the power of the Blue Shark to sustain injury are fully equalled by what is known of the present species; but a single instance may be thought sufficient to establish the fact. In the month of July, when the warmth of the season may be judged to have exerted some influence, a large Skate was caught with a line at eight o'clock in the evening, but it was not brought to land until the same hour on the following morning; soon after which time the stomach and entrails were cut out and removed. At three o'clock in the afternoon the cavity of the chest was also cut open, and in doing this the heart was deeply wounded, when it was

observed that the auricle of the heart, (or that part of it to which the blood is returned from the veins, before it again enters the heart for a renewed circulation,) was in continual action, although the other portion of that organ remained at rest. At nine o'clock in the evening, and twenty-five hours after its capture, this pulsation continued at the rate of five throbs in a minute, and probably for several hours following; thus also affording proof that the auricle is the last part of the body to die, as it is believed to be the first to shew signs of life. In other instances the heart has been removed from the body, and in that condition the pulsations of its muscular structure have continued for the space of twenty-four hours.

The Skate is never the special object of the fisherman's search, and when it chances to take the hook it may give him perhaps a greater amount of trouble than the prize can repay. As if sensible of danger, it will lie as still as if the line had got entangled with a rock; in which case the only resource is patience, for an attempt to raise it from the ground will only have the effect of causing it to remain more still. If, however, the head be raised, the body will follow, and the fish ascends like a kite into the air, the effort of the fisherman being directed to gather in his line in such a manner, so that the fish shall not be able again to turn its head downward; which, if it did, no strength he could employ would interrupt its descent.

The value of this fish as an article of food is very differently thought of in different parts of this kingdom and of Europe. Risso says it is not a common fish at Nice, but that it is held in high estimation, and Lacepede also speaks of it as a delicacy. But the most favourable account is by Willoughby, who records a remarkable instance, in which, owing probably to excellent cookery and exquisite sauce, a single fish of this sort, weighing two hundred pounds, dressed by the cook of St. John's College, in Cambridge, was found to have satisfied the appetites of one hundred and twenty learned gentlemen. Lacepede says that it is salted and dried for exportation in many places, and particularly in Holstein and Sleswick, and in that state it is sent to Germany for sale. In our own country we have seen it, thus prepared, in the market at

Penzance. Fish of small size, as well of this as of some other kinds belonging to the same family, are popularly called Maids, and under this name are sometimes found in the market. They are esteemed by fishermen, whether fresh or salted; but those of full growth are purchased at a low price by the crab and lobster fishermen for bait; and, if not so sold, they are thrown aside for manure, for which purpose they are of much value. A freshly caught Skate is good bait for a crab, but it is most successful for a lobster when it has been kept long enough to have become stale.

The fish leech, *(Hirudo muricata,)* is more frequently parasitic on this species than on any other of the family.

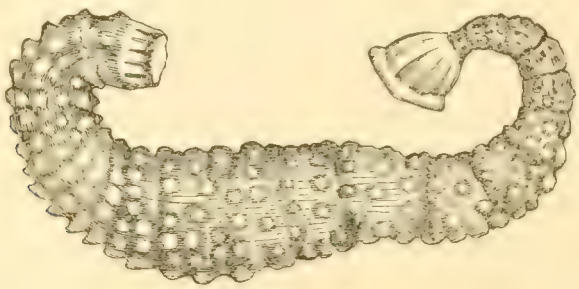
The body is in form of a rhomb or lozenge, rounded off on the hind parts, from whence a slender tail tapers to the end. The snout projects, and from thence the sides of the disk slope away to the extremity of the expanded pectoral fins: a line drawn from the extended borders of these fins across the disk, passes considerably behind the middle of the body. The mouth is on the lower surface, much behind the snout, and capacious within; the teeth numerous, in longitudinal rows, thickly covering the jaws; the largest in the middle, which are broad at the base, pointed, and with the points directed inward. Nostrils lobed, and near the angle of the mouth; gill openings five on each side, converging. Ventral fins broad and flat, enclosing the vent. Eyes on the top of the head, at the same distance from the snout as the mouth, separate, and looking towards the sides; a spiracle behind each eye, communicating with the roof of the mouth. The caudal portion slender, less than the length of the body, depressed, with two rounded fins near the end. The body is often covered with small prickles, and I have seen an example where even the larger spines have been wanting, so that no dependence can be placed on them as specific marks; but in general the males have a larger number of these spines than the females. They are usually furnished with a narrow border or bed of them near the margin of the pectorals, and one (sometimes three) imperfect rows on the middle of the back; the tail possesses three rows, of which one passes along the middle to the first dorsal fin, and the others run along the borders, their points directed outward. The usual dimensions of this

fish are, from the snout to the mouth one part to three and three quarters of its breadth, and less than one fifth of its whole length. The males, like the Sharks, are distinguished by claspers attached to the ventral fins, but they are larger in proportion to the bulk of the fish. The colour of the upper parts is dusky or grey, variously mottled; and in the younger examples the tail is marked with rings of colour. It often reaches the weight of a hundred pounds, and would scarcely be thought extraordinary if of double that magnitude.

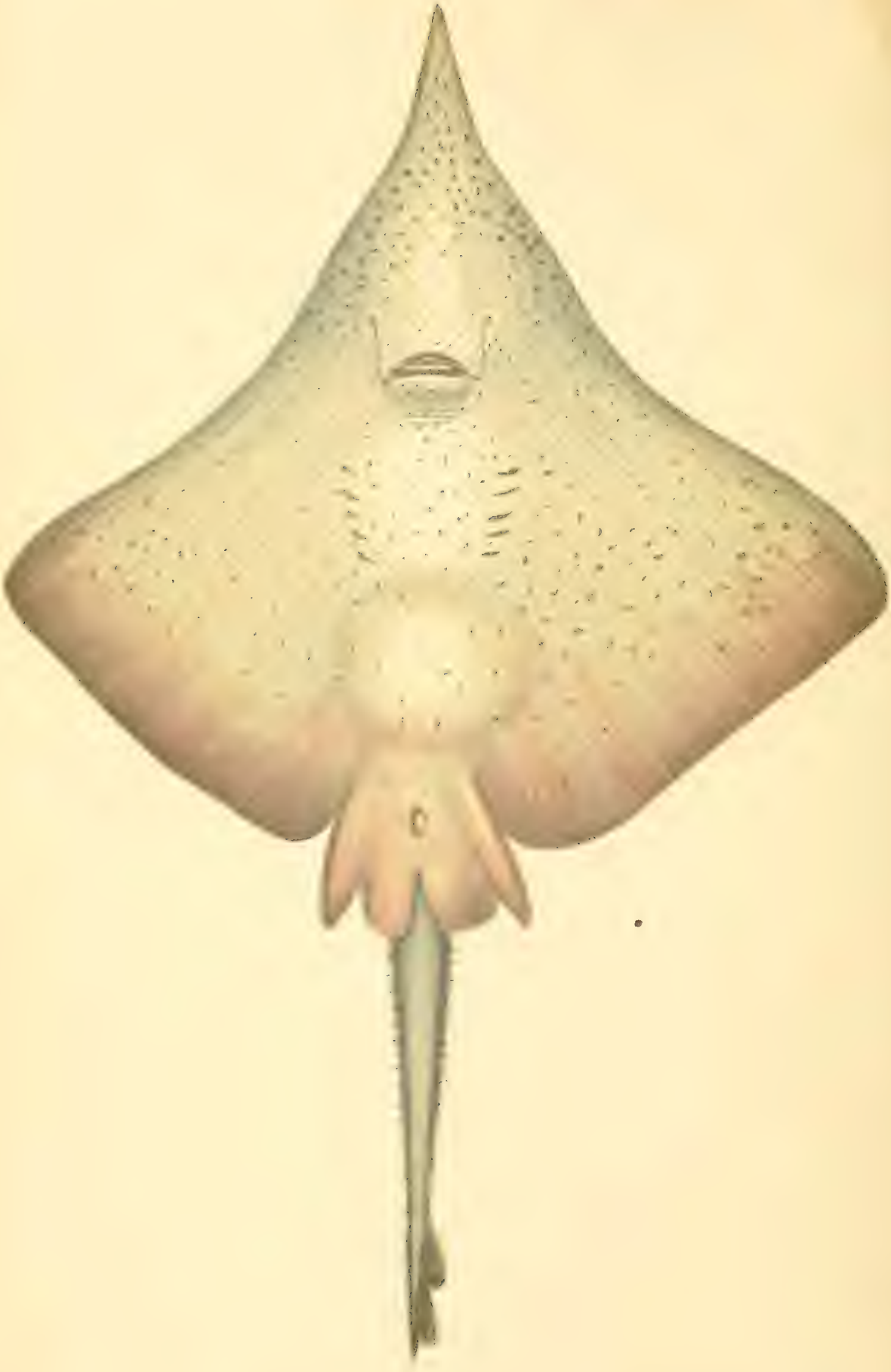
I have thought it proper, in my introductory remarks on the newly-named genus, *Batis*, to direct attention to the conspicuous mucous glands which characterize this division of the great family of *Plagiostomes;* and Monro has thought them worthy of a separate chapter in his work on the "Physiology of Fishes." "In the Skate," says he, "numerous orifices, placed pretty regularly over the surface, have been observed by Steno to discharge the slimy matter. With respect to these last I have remarked some memorable circumstances. First, I have discovered one very elegant serpentine canal between the skin and muscles, at the sides of the five apertures into the gills. Further forwards it surrounds the nostrils, then it passes from the under to the upper part of the upper jaw, where it runs backwards as far as the eyes. From the principal part of this duct in the under side or belly of the fish, there are not above six or eight outlets; but from the upper part near the eyes there are upwards of thirty small ducts sent off, which open upon the surface of the skin. The liquor discharged from these has nearly the same degree of viscidity as the synovia in man. But besides the very picturesque duct I have been describing, I have remarked on each side of the fish, a little further forwards than the foremost of the five breathing holes, a central part, from which a prodigious number of ducts issue, to terminate on almost the whole surface of the skin, excepting only the snout or upper jaw. At these centres all the ducts are shut; and in their course they have no communication with each other. In these two central parts, or on the beginning of the mucous ducts, a pair of nerves, nearly as large as the optic, terminate; and, which is a curious circumstance with respect to them, they are white and opaque in their course

between the brain and these ducts, but when they divide they become suddenly so pellucid, that it is impossible to trace them further, or to distinguish them from the coats of the ducts. The mucus of these ducts is so extremely viscid that it is difficult to squeeze it out." The author further remarks on the importance of this secretion of mucus to the fish, that so much nervous energy as is shewn by the magnitude of the nerves themselves, is required to preside over its formation; and he might have added, that this secretion appears to go on long after the death of the creature, as it does also in some others of this family of fishes; for it is in the experience of fishermen, that in preserving them with salt for their subsistence in winter, to use their own phrase, they take salt very slowly. It is found, in fact, that a continual flow of this tenacious mucus will prevent the actual application of the salt to the surface of the skin, so that it becomes necessary to make incisions into the flesh for the purpose of preserving it. Several days will pass before this preserving process can be said to have begun in consequence of the interposition of this glairy fluid. It is not improbable that the salt itself may act as a stimulus on the ducts, and thus produce that continued flow of the secretion which counteracts its own effects.

This fish is sometimes found with an irregular formation, consisting of an interruption in the continuity of the outline reaching from the snout along the anterior border of the pectoral fin. Of such a one we give a figure, (page 96,) but it is not, as has been supposed, when it has occurred on both sides, the mark of a separate species.



PARASITE ON THE SKATE.
(Hirudo muricata.)



LONG-NOSED SKATE.

XIX

LONG-NOSED SKATE.

Raie museau pointu, Raia acus,	Risso.
Raia mucronata,	Cornish Fauna, p. 25, but not the references.
" "	Couch's MS. in the Library of the Linnæan Society.
" "	Yarrell; Br. Fishes, vol. ii, p. 550.
" *acus,*	Gray; Catalogue of Br. Museum, p. 140. It is a question whether this is not the *Raia oxyrhynchus major* of Willoughby, p. 71.

This species was not known to the older writers on natural history, but in Risso's "Icthyologie de Nice," and in Dr. J. E. Gray's "Catalogue of the Fishes in the British Museum," I find a reference to Lacepede, who called it by the names quoted from Risso. Still I do not find any mention of it in my copy of Lacepede's "History of Fishes," dated in the sixth year of the republic.

This species is less frequently taken than the Common Skate, and not usually in the winter. The earliest I have met with have been caught in April; and as also examples of small size do not fall into the hands of fishermen, we may suppose that their usual haunts are, with their parents, in deep water. Fishermen report that when this fish has swallowed the hook, it becomes more violent in its efforts to free itself than the other species of this family. No further use is made of it than to extract oil from its liver.

The length of an example of the ordinary size was four feet seven inches, of which the tail measured sixteen inches; the greatest breadth three feet and about an inch; and from the snout to the mouth fourteen inches, the prominency of the snout extending thus to a much greater length than is found in any other of the British species of this family.

From the snout to the widest portion of the pectoral fin in a straight line twenty-eight inches and a half, and along the curve thirty inches, the snout being narrow as well as prominent, and forming an acute angle backward to behind the eyes, where it spreads suddenly wider; the greatest width behind the middle of the disk. The eyes not large, and at considerably more than half the distance from the snout to the middle of the body. Behind the eyes there are obscure spines; the mouth narrow; teeth sharp; nostrils lobed. The body smooth, much depressed, and of a light lead-colour; the tail rather rough, with a row of large hooked spines on the border on each side. Fins on the tail near each other, nearly the length of one of them from the end. On the under side it is spotted with dusky marks, as in the Common Skate. This example was a female, and in all instances of this family the males are more abundantly furnished with spines than the females. The comparative proportions of this species, laid by the side of the Common Skate and the Burton Skate, which is another of this family with a protruded snout, are found to be, that a Common Skate of five feet in length measured eleven inches and a quarter, and a Burton Skate of six feet in length one foot from the snout to the mouth; when a fish of this species, of much less size, measured between the same points fourteen inches, thus extending to more than one third part of its greatest breadth, and more than one fourth of its whole length. In the Common Skate the latter proportion is less than one fifth, and of the Burton Skate one sixth.

FLAPPER SKATE.

XX

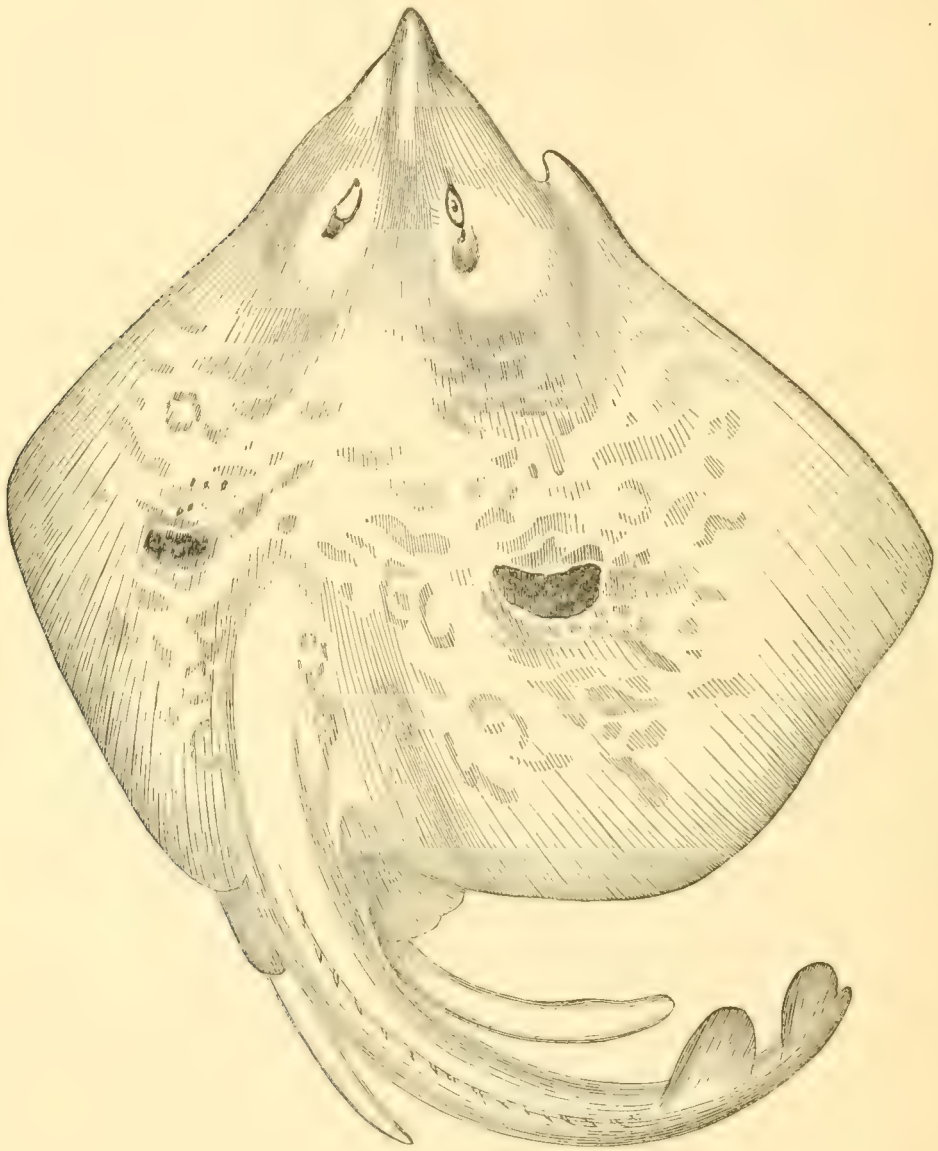
FLAPPER SKATE.

Batis intermedia, Nobis.
Raia intermedia, Parnell; in Yarrell's Br. Fishes, vol. ii, p. 558.

Dr. Parnell, who had well studied the fishes of Scotland, believed he had discovered or distinguished a new species of Skate, that was specifically distinct from the common sort, but which, at least by naturalists, had usually been confounded with it. The people of that country were accustomed to call it the Flapper Skate. His description of the characters by which he would distinguish it are,—the upper surface perfectly smooth, without granulations; the anterior part of the orbit of the eye having a strong spine pointing backwards; the dorsal fins more distant from each other than in the Common Skate, and the anterior margins of the pectoral fins more concave, giving the snout a sharper appearance. Colour of the back a dark olive, spotted with white; the under surface a dark grey. The specimens examined were young, as appears from their small size, no one exceeding two feet in length.

With regard to these particulars of distinction, there are some of them which can weigh but little, for there are few fishes which do not vary greatly in colour according to the nature of their haunts; and all the young ones of this family are ornamented with more lively tints than those of greater age, and also with a different distribution of the markings. The number of spines on the body is not less liable to variation, but the outline of the disk is more deserving of attention. We give a figure of a fish which answers closely to the description of the Flapper Skate given by Dr. Parnell, except in such particulars as I know to be liable to variation and uncertainty. Further observations will be required to settle this question of identity. The habits of the Flapper

Skate, such as I know it, are much like those of the Common Skate. It grows to about the same size, and the fishermen in the West of England do not distinguish one from the other.



SKATE—MALFORMATION.

BURTON SKATE.

XXI

RAIA.

The generic characters differ from those of the genus *Batis*, only in that the under portions of the body being of a pure white colour.

We assign no importance to the form of the teeth as a generic character; since, within some limitations, they are found to differ according to age, sex, and accident.

BURTON SKATE.

WHITE SKATE. SHARP-NOSED RAY. FRIAR SKATE. MAVIS SKATE.

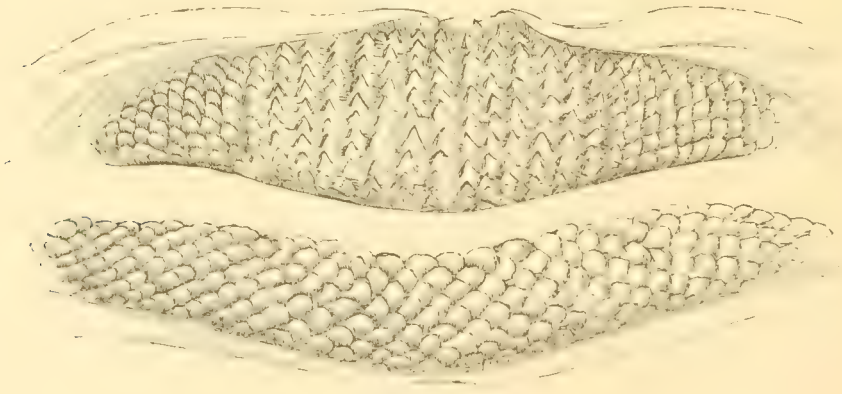
Raia oxyrhynchus,	Linnæus. Jenyns; Manual, 511.
" "	Fleming; Br. Animals, p. 171.
" "	Yarrell; Br. Fishes, vol. ii, p. 556.
Raie oxyrinque,	Lacepede and Risso.
Raia Lintea,	Gray; Catalogue Br. Museum, p. 140, (after Müller and Henlè.)

The name of the Burton Skate is believed to be derived from a small fishing town in France, where this fish is held in estimation; or at least the fishermen of that place were purchasers of it in English ports.

This is a common species; but as it keeps in deep water, it is less frequently taken in winter. The young ones however are caught occasionally in the shortest days, and consequently remain nearer the land at that season. It is the latter only that find acceptance at the fisherman's table in England; and Risso says that the full-grown fish is but indifferent food. But it appears to be valued in France. Ray, in his Travels in the year 1658, says that the people of that country were accustomed to come to St. Ives, in Cornwall, to purchase this sort of fish; and the same practice, with a little variation, has continued to the present time. Fishermen inform me that it is this species to which they give a preference; and they cover them with moist sand, to give them the appearance of being newly caught. This practice is contrary to the law in France; for as there is a bounty paid in that country on the importation of fish, designed for the encouragement of the fisheries, the object of this

payment is defeated when the fish, instead of being caught by themselves, are purchased from foreign fishermen. The French Government has more than once sent a ship to England for the purpose of detecting the offenders.

This is the largest of the British Rays. For, whilst its measurement is often equal to that of the largest Common Skate, its greater thickness causes it to be of heavier bulk. The snout protrudes considerably; and the borders of it pass backward in a slightly diverging form for three or four inches. The outline of the anterior border of the disk thus becomes more curved than in the generality of this family; since an expansion takes place again nearly opposite the eyes, with a second contraction before it spreads out to the full extent of the pectoral fins. The widest portion is behind the centre. Mouth considerably removed from the snout, armed with stout sharp teeth; nostrils lobed. The eyes distant from the snout; spiracles large, and close behind the eyes. The tail depressed; having two fins near each other, and close to its end. Behind the eyes are stout spines; and at the border of the disk opposite the eyes a row of crooked spines, the points directed backward. A large longitudinal bed near the extremities of the pectorals; three rows on the tail, that which runs along the middle passing to some distance up the back; none of them placed close to each other. On the under surface a row of crooked spines at the border a little before the mouth. On a female I only find the spines behind the eyes, and on the tail. Colour ash or grey, with faint spots above; below white. Its claspers are proportionally longer and stouter than in most of the British species of Skates or Rays.



Inside view of Jaws of Thornback Ray.

THORNBACK RAY.

RAY-MAID.

Raia Clavata,	Linnæus. Willoughby; p. 74.
" "	Bloch; pl. 83, but the tail too long.
Raie Bouclèe,	Lacepede. Risso.
Raia Clavata,	Fleming; Br. Animals, p. 170.
" "	Jenyns; Manual, p. 205.
" "	Yarrell; Br. Fishes, vol. ii, p. 582.
" "	Gray; Catalogue Br. Museum, p. 136.

This is one of the commonest of the Rays, and the most valued; as it affords a large amount of nourishment in a form readily digested by the stomach. By fishermen accordingly it is frequently reserved in a salted state for the subsistence of their families, at a time when the state of the weather forbids them from following their employment at sea. It is best preserved under heavy pressure; as we are informed is also the case with the Skate in some parts of Scotland; particularly in the Moray Firth. But, as we learn from Walter Gregor, Esq., of Macduff, in the practice of that neighbourhood the use of salt is dispensed with. Large stones are heaped upon them in order to press out the juices; and the only attention paid to it afterwards is, to secure it from rain and moisture. The water in which either of these fishes has been boiled, employed as a bath, is in repute for the cure of the gout.

The Thornback is found in shallower water, and nearer land, than most others of this family; and in consequence is taken at all seasons. But its numbers are much lessened of late years; the cause of which is supposed to be the increased practice of fishing with trawls; by which not only the young ones, too small to be used as food, are destroyed, but the ground is torn up, and the food on which the fish must subsist dispersed, with the destruction of the shelter necessary for the perfection

of the eggs. A similar charge is laid against the trawl as regards several other sorts of fish; and it is to be regretted that what is otherwise a very valuable employment, and an excellent nursery for sailors, cannot be followed without inflicting injury on their brethren of the line and net; the opposite of which might be the case if some regulation regarding the times and distances of this sort of fishing were brought into action.

This species is particular in the selection of its food; so that from being scarce it has become suddenly abundant on a change of bait; the pilchard and herring being amongst its choicer morsels; but it also feeds on crabs and other crustaceans in great abundance.

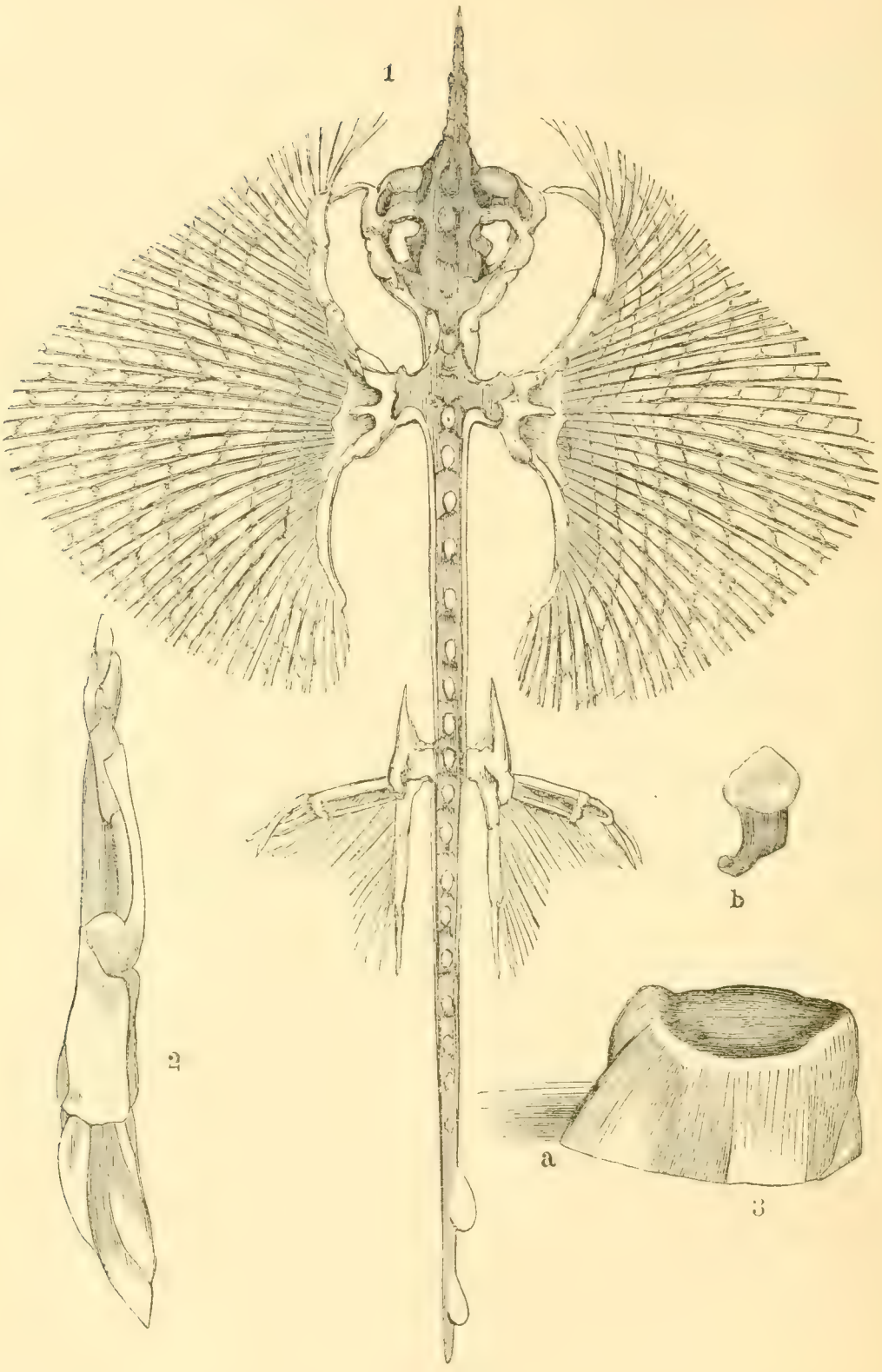
It is sometimes known to come to the surface, even over a considerable depth of water; and in the month of March fishermen have noticed many at a distance of several miles from each other, where the water has been more than thirty fathoms in depth, stemming the tide without difficulty, but neglecting the offer of a bait. The Common Skate has been seen near the surface under the same circumstances; and it has been supposed that this occasional habit is in some way connected with the season of propagation. The egg cases are deposited in succession in May and June; and it has been remarked that females are met with in greater numbers than males.

In an example three feet two inches in length, the tail measured eighteen inches and the breadth twenty-eight inches; the widest extent being behind the middle of the disk. The snout short, to the eye five inches and a half; the eye separate, and elevated; spiracles large. The mouth five inches from the snout, with teeth rough at first, but generally flat like mosaic pavement; nostrils lobed. Border of the body from the snout at first rounded, then slightly concave to the extremity. Ventral fins small; dorsal fins two, rounded, and near the end of the tail. Body moderately thick, rough above, with large hooked spines scattered over the surface, the embedded root of each spine round and solid. Three rows of stout spines along the tail, the middle one running up the back. Colour of the upper surface, mottled with yellow, brown and dark, white below. The tints of colour vary, and in younger examples what at last appear mere blotches, are regular rings or waved lines. It is common to find some stout spines on the under surface, and

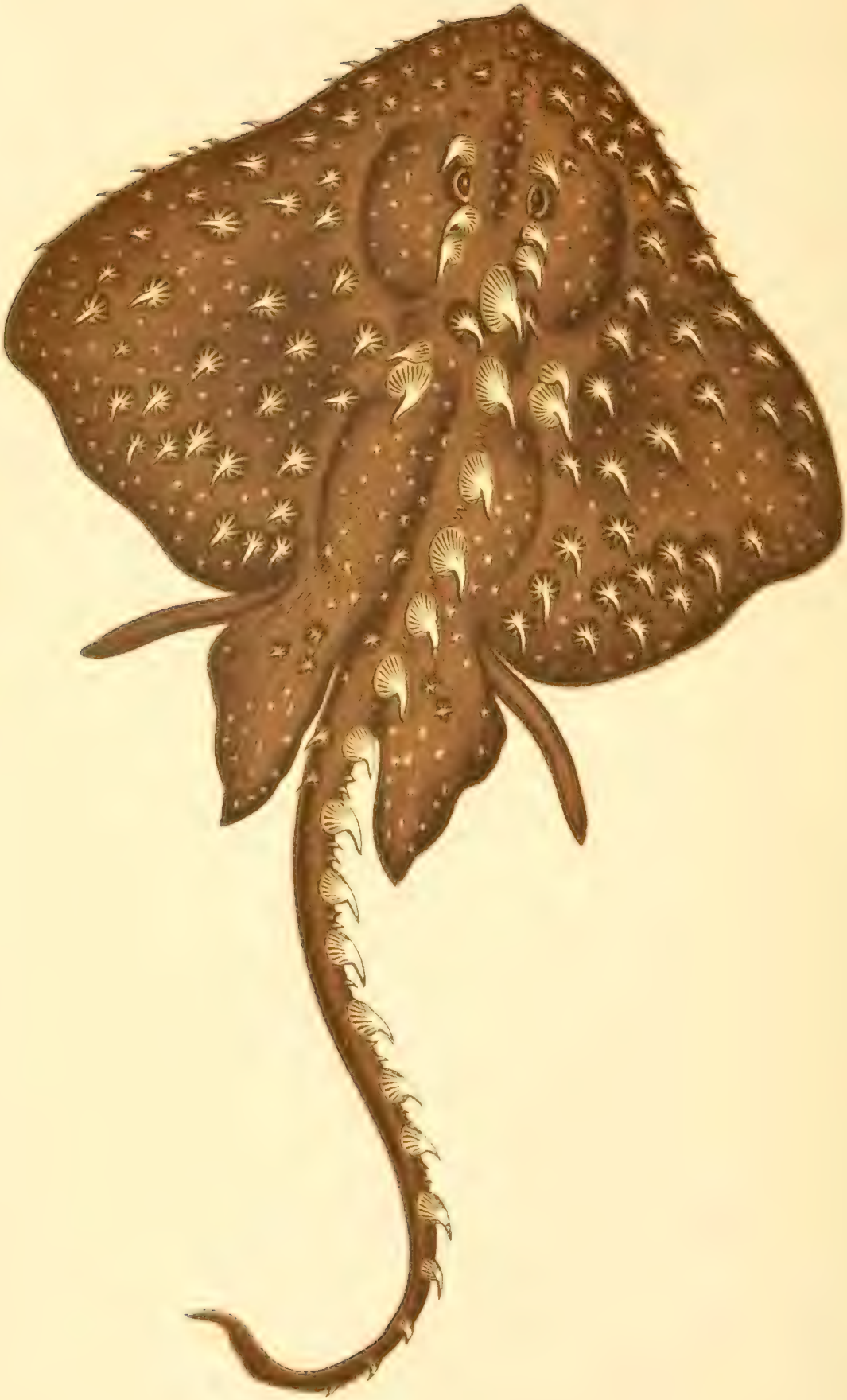
sometimes the skin is covered with evident roughness; a circumstance which has led some observers to suppose such examples to constitute separate species. I have also met with some singular varieties, and of an opposite kind, which require notice in this place. A male example, taken in comparison with another of the same species, agreed with it in every particular, except that its skin was altogether smooth, except a few rough grains on the point of the snout, and the usual spines over the eyes and on the border of the disk at the pectoral fins. The usual roughness of the skin was altogether absent, and not a single hooked spine existed otherwise on the body. The colour was pale dusky brown, and not mottled, as is constantly the case in ordinary examples; but having some fine longitudinal lines. The liver was remarkably small, and black as if it had been soaked in ink.

In another example, which in form also closely resembled the common Thornback Ray, no hook or spine could be discovered, except a row that passed from the head along the back and down the middle of the tail; with none behind the eyes or on the sides of the tail. Surface of the disk very rough, more so than in the common examples of this Ray; the teeth flat as in that fish, and in the centre of each tooth was a depression, which was softer than at the border; so that each separate tooth resembled a wide ring. The surface of the disk was an intense black, but near the head bordered with a lighter colour; and over the surface were scattered a few round spots of a still darker colour.

I have not thought it necessary to regard these examples as forming distinct species; principally because there are none described by other observers to which they can be referred; the *R. rubus* of Linnæus and other authors appearing to me to be a very uncertain species; and the resemblance of form was in all respects, except the particulars here given, like that of the Thornback Ray.



1.—Skeleton of Thornback Ray. 2.—Skeleton of Male Clasper of Thornback Ray.
3.—Superior view of the eye of Thornback Ray;
a, the anterior part; *b*, the pedestal of the eye.



STARRY RAY.

Raia radiata,	Fleming; Br. Animals, p. 170.
" "	Donovan; Plate 114.
" "	Yarrell; Br. Fishes, vol. ii, p. 585.
" "	Jenyns; Manual, p. 517.

In the writings of the older authors on Natural History, several species of Rays are mentioned as having the skin covered with spines or prickles, as well below as above; but most of them are described so imperfectly, that it has not been possible to distinguish them generally one from another, or to know whether they are more than accidental varieties. There can be little doubt that the fish now known as the Starry Ray is one of these uncertain kinds; but in our references we must be content to confine our notice to writers of a late date; among whom Donovan is to be distinguished for his figure, and Fleming, Jenyns, and Yarrell for the description. The likeness given by Donovan appears to have been drawn from a newly-caught example, and is to be viewed as highly characteristic. Mr. Yarrell's figure is from a dried skin, which I remember to have seen in that gentleman's possession; and it is the only one which I have had an opportunity of inspecting; for this fish is a native of the more northern parts of the British Islands, and has not been found in the south or west. In its shape it closely resembles the Common Thornback, but it is to be distinguished from it by the form of the spines, especially of their base; and in some measure also by the teeth, which are more sharp. In the Thornback the hooked spines arise from a round and solid base implanted in the skin; but in the present species the base is formed of spreading rays. In the absence of a specimen we copy the plate of Donovan, No. 114. The habits of this species, as differing from those of its family it so much resembles, appear not to have been observed.

SPOTTED RAY.

HOMLIN. TAILY.

Raia oxyrinque,	Lacepede.
" *miraletus,*	Donovan; pl. 103, but without those staring marks, from which this fish has sometimes been called the Mirror Ray; as if they formed an essential character, which is not the case.
" *maculata,*	Jenyns; Manual, p. 514.
" "	Yarrell; Br. Fishes, vol. ii, p. 570.

It is surprising that so common and well-marked a species as this, should have been so little known and distinguished by writers; I therefore join with M. Jenyns in excluding from the list of corresponding names those which perhaps have been affixed to it; but which by having been applied to other species also, would only serve to increase the confusion. The conspicuous spots seen in Donovan's figure, and also in that of Mr. Yarrell, are far more frequently found on other species; and I know only one, the *R. miraletus,* which I judge to be the young condition of the Shagreen Ray, in which they form an important character. Some marks of their younger condition remain with the Spotted Ray, and also with the Thornback Ray, through the first year of their growth; about which time they measure about fourteen inches in length. The caudal portion still remains proportionally longer than at a later period, and the third lobe of the tail is still wide along the base, which has not yet contracted as it is afterwards found. The spines on the disk are fully formed, but of less size than afterwards, and the markings in both these fishes are more regular and beautiful, although of course differing in each; and indeed they are rarely alike in any two individual fishes. In the Thornback the disk is sprinkled with ocellated spots or

rings, of a light yellow colour, with a dark margin; their distribution having some degree of regularity on each side; but in the Spotted Ray the marks consist of plain dark spots regularly scattered; especially along the middle of the back and tail. In the adult condition these marks have become broken up in the Thornback, and irregular in the Spotted Ray; both fishes having attained the adult condition when the tail has become shortened at the end, and the third fin at its extremity has disappeared.

The name of Sharp-nosed Ray is scarcely more appropriate than that of Mirror Ray; since although in that respect it does a little exceed the Common Thornback, with which at first perhaps the comparison was made; yet there are others of the tribe which possess a much more protruded snout.

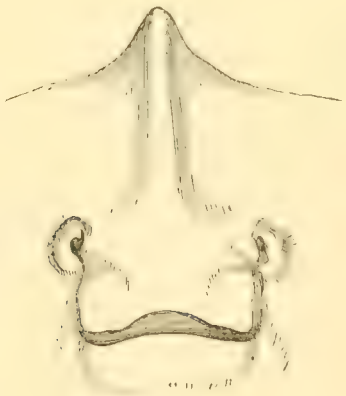
Lacepede quotes from some unmentioned author the name of *Raia mucosa;* and in confirmation of its meaning I learn that its surface is so covered with slime, and remains in that condition so long after the fish is dead, that for several days salt cannot be effectually applied to the skin, so as to preserve the fish for future use; and incisions in the surface are therefore made to secure that effect.

The example selected measured three feet nine inches in length, of which the tail was eighteen inches; the breadth thirty-two inches. The snout short, and from thence a small sweep and curve to the extremities of the pectoral fins. The eye is six inches from the snout; spiracles large, and close behind the eyes. Tail depressed; two rounded fins near its end, the first a little overlapping the second. The teeth small, numerous, and pointed. Surface of the body rough, the roughness caused by fine spines, which have radiated bases; those passing along the back rather the largest. No spines behind the eyes; three rows, with a few others scattered about, on the tail. Colour above dusky, thickly covered with round dark spots of the size of a pea; the under surface smooth, and a pale white.

I have seen, and closely examined, an example which exactly resembled this species, but which was all over rough below as well as above, and having here and there a more elevated crooked spine, answering to each other on the opposite sides of the body. There were spines also behind the eyes;

the smaller spines, but not the larger, having a radiated base. It was a female; the teeth flat, as in the Thornback, each tooth being an exact square, with an angulated corner. This would be the *Raia rubus* of authors; but it appeared to me to be only a variety of the Spotted Ray.

The Spotted Ray exceeds the Thornback in weight when of the same size; and one of these fishes is equally common, and by fishermen equally valued, as the other. But the Spotted Ray usually is found nearer the shore, and its purses are shed in such shallow water, as to be often thrown on shore, with their precious burthen within them by the storms of winter. The purse is smaller than that of the Thornback, although the parent fish is of somewhat larger size; and I have obtained the young from the purse from November to January, the length at that time being about five inches, of which the tail was two inches and three eighths; the breadth three inches; with the spines even then developed.



Nostrils of young Spotted Ray.

PAINTED RAY.

PAINTED RAY.

SMALL-EYED RAY.

Raia microcellata,	Fleming; Br. Animals, p. 171.
" "	Jenyns; Manual, p. 515.
" "	Yarrell; Br. Fishes, vol. ii, p. 567.
" "	Gray; Catalogue Br. Museum, p. 109.

The length of a specimen was thirty-three inches and a half, of which the tail measured thirteen; breadth twenty-four inches. The eyes three inches asunder, and five and a half from the snout. In general form it resembles the Thornback. Along the tail is a border on each side, like a membranous fin; the two fins separate, the hindmost an inch from the end. Eyes very small, spiracles large. The body covered with rough grains, but without spines, except that a row runs along two thirds of the length of the back, and on the middle of the tail to the fins; an irregular row of hooked spines along each side of the tail. Nostrils with a prominent expanded membrane. Width of the mouth three inches; teeth flat, like those of the Thornback.

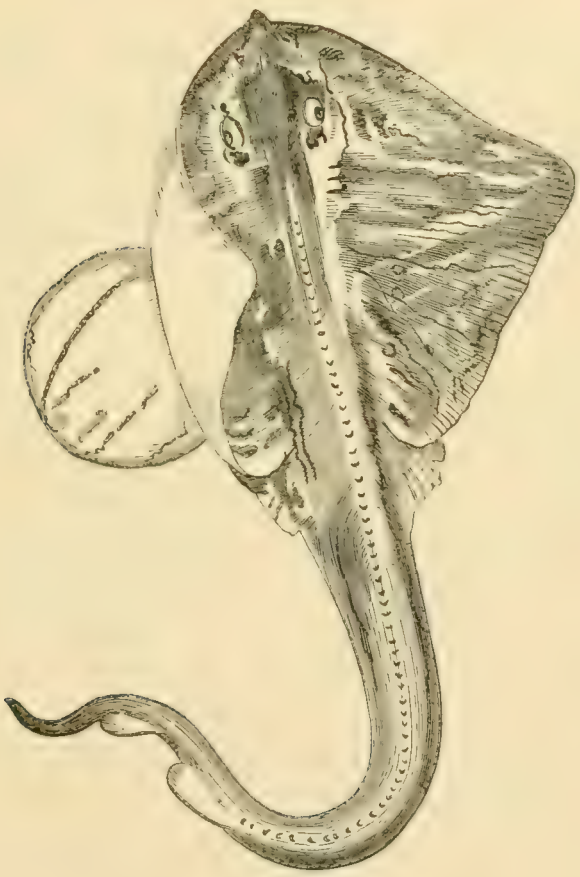
There is much beauty in the distribution of the colour. The upper surface is a light grey, with a line of lighter colour from the back along the tail, enclosing the central row of spines; and the disk is regularly divided, first by three lines enclosing each other, passing from near the eye circularly to near the expansion of the pectoral fins, with the convexity inward, and consequently the shortest line nearest the border. On the hindward border of the pectorals are two other lines, which pass from behind the expansion circularly to the neighbourhood of the abdominal fins, the convexity also being inwards. Within these segments are several brown spots and streaks, and a few whitish spots, answering to each other on both sides; and

the extreme border of the pectorals behind their greatest expansion, as also the abdominal fins and margin of the tail, are edged with white. The under part of the body is white and smooth.

Another example differed considerably from the former in the nature and distribution of its colours, which were still more beautiful. The ground colour was a brilliant yellow, marked with numerous gyrations, which were lyre-shaped, each side of the disk answering to the other, these gyrations being formed of a dark line, margined on each side with a series of pale yellow spots, like beads. This was a male, but the first-named, caught at the end of January, was a female, with eggs of full growth. About the same date in another season, I obtained a young example from a purse which had been washed on shore in a storm, and which was so far developed that about half the substance of the egg had been absorbed into the body. It was beautifully marked over the surface, and, as there were some particulars in which it differed from what is usually seen in very young specimens of most of the species of this family, I add a more minute description. The length was five inches, of which the tail measured three inches and a line; breadth two inches and two lines; from the posterior edge of the hindmost dorsal fin to the end of the tail six lines. The head well armed in front and round the anterior portion of the disk, and also on the top of the head; a line of spines down the back and tail, from opposite the third gill orifice; a stout spine on each side of the back, at a little behind the space opposite the hindmost gill orifice. The tail stout and greatly tapering, the sides with a border, and rather wide membrane along the middle of the under side. The hindmost caudal fin extended back in a thin membrane to the extremity, where the termination tapers finely, and shews much active motion and sensibility of feeling. The colour of the body is pale yellowish brown, regularly lyrated on each side and towards the borders. The caudal portion is towards the end marked with broad bars. Some spines were visible that were not yet through the skin. Although not yet fully developed, it continued alive in water for eight days. Another example, also in an early stage of development, had the spines on the snout and border of the pectorals, with

beautiful lines and gyrations on the disk. It appears that the young ones of Rays in general are without the claspers.

That this fish is less rare than has been supposed appears from the fact, that on another occasion, in the month of April, I saw several of them that had been drawn on shore in a ground sean on different days. They were not of the full size, and a male fish among them was marked in the same manner as the female I have described. This species has not hitherto been taken anywhere but on the south coast of Devon and Cornwall, and only twice, that I am aware of with a line; the reason of which appears to be that it is more select in its food than most others of the family. It was found to be equal to the Thornback for the table.



Young Painted Ray and Egg.

BORDERED RAY.

Raia marginata,	Jenyns; Manual, p. 512.
" "	Yarrell; Br. Fishes, vol. ii, p. 564, the figure from a dry skin.
" "	Gray; Cat. of Br. Museum, p. 138.
Raie petit museau,	
R. rostellata.	Risso.

The length of the specimen was eleven inches and a half, of which the body, to the origin of the caudal portion, was six inches and a half; the greatest breadth nine inches. The snout projects, slender; and, from it to the extremities of the pectoral fins, the border is much waved. Eyes five eighths of an inch asunder, and one inch and six eighths from the snout. Spines in front of the eyes, and in three rows along the tail, long, and sharp. Dorsal fins near each other, and not close to the end of the tail. Colour pale yellow, white below; but what has rendered this fish remarkable, and given it a name, is a very dark or black border which passes round the disk, both below and on the upper side, from about the middle of the body to the hinder part of the pectoral fins.

I am indebted to the kindness of William Thompson, Esq., of Weymouth, for a specimen of this fish, which lays claim to the distinction of being regarded as a separate species; and the best account I am able to give of it, is contained in the letter of that gentleman, which accompanied the gift. "The Marginata Ray," says he, "is rather plentiful in Portland Roads, on a sandy bottom, and is caught both in seans and trawls. It is a shallow water species, and at present I have never heard of one exceeding fifteen inches. The fishermen here will have it to be the young of some other species, but can give no reasons. It is, however, taken all the year round,

and all are nearly of the same size. The Margined Ray prefers sandy bays, partially landlocked, and not very deep water;" from which cause it is more frequently caught in the sean than in the trawl, the fishing with which is at a greater distance from land. I learn from a later communication of Mr. Thompson, that the Bordered Ray has of late become much more scarce near Weymouth, if not altogether disappeared.

Besides its small size, there are on the disk of this fish numerous marks of blood-vessels, and perhaps nerves, which are usually to be discerned in the young of the various kinds of Rays, and in them only. I feel therefore strongly inclined to adopt the opinion of the fishermen, even although it may be opposed to that of so good an observer as Mr. Thompson, and of such other able naturalists as have taken the other side of the question. The only difficulty I feel is in assigning it to any other recognised species, of which the Burton Skate is the only one to which it bears a near resemblance. That the black border exists in different degrees in different individuals or situations, appears probable from a comparison of the figures given by Risso with those of Mr. Yarrell and our own; and it is also probable that it is a local colour derived from particular food, or some special character of the ground, disappearing altogether in the further growth of the individual, which then also may change its haunts for some at a greater distance. No example has yet been discovered in the condition of producing eggs, which circumstance will still further tend to strengthen the opinion of its being the young condition of another species.

CUCKOO RAY.

Raia miraletus, NOBIS.

THIS well-marked species has been overlooked or mistaken by many naturalists, in consequence of its having been characterized chiefly by a mark which, more obscurely, is often shared by other kinds of Rays, to which it has given a distinguishing name; and the mark itself having thus been found to lead to mistake, the conclusion has been rashly adopted that it is of no use as a distinction; and that the fish which most commonly and conspicuously is adorned by it, is furnished with no other character to constitute it a distinct species. It is on account of this that I shall describe the kind of Ray known to fishermen as the Cuckoo Ray, at greater length than I should otherwise do, and particularly in reference to the species called the Shagreen Ray, and another, named by Mr. Yarrell the Sandy Ray, with either of which it may be confounded, and from the latter of which especially it is necessary to distinguish it.

The length of an example of the ordinary size, selected for description, was twenty inches, of which the tail measured twelve inches, and the breadth across the disk fifteen inches. The teeth very numerous, crowded, sharp, and hooked. The anterior outline of the disk waved; the snout moderately projecting; eyes remarkably prominent. Surface of the disk covered with fine, thin, hooked prickles. The tail stout at its origin, tapering posteriorly, with two fins near its end. Spines on the snout, a row round each eye, and four short rows behind the spiracles; two rows begin high on the back and run along the middle of the tail, with a depressed or channeled space between them: five rows in all run along

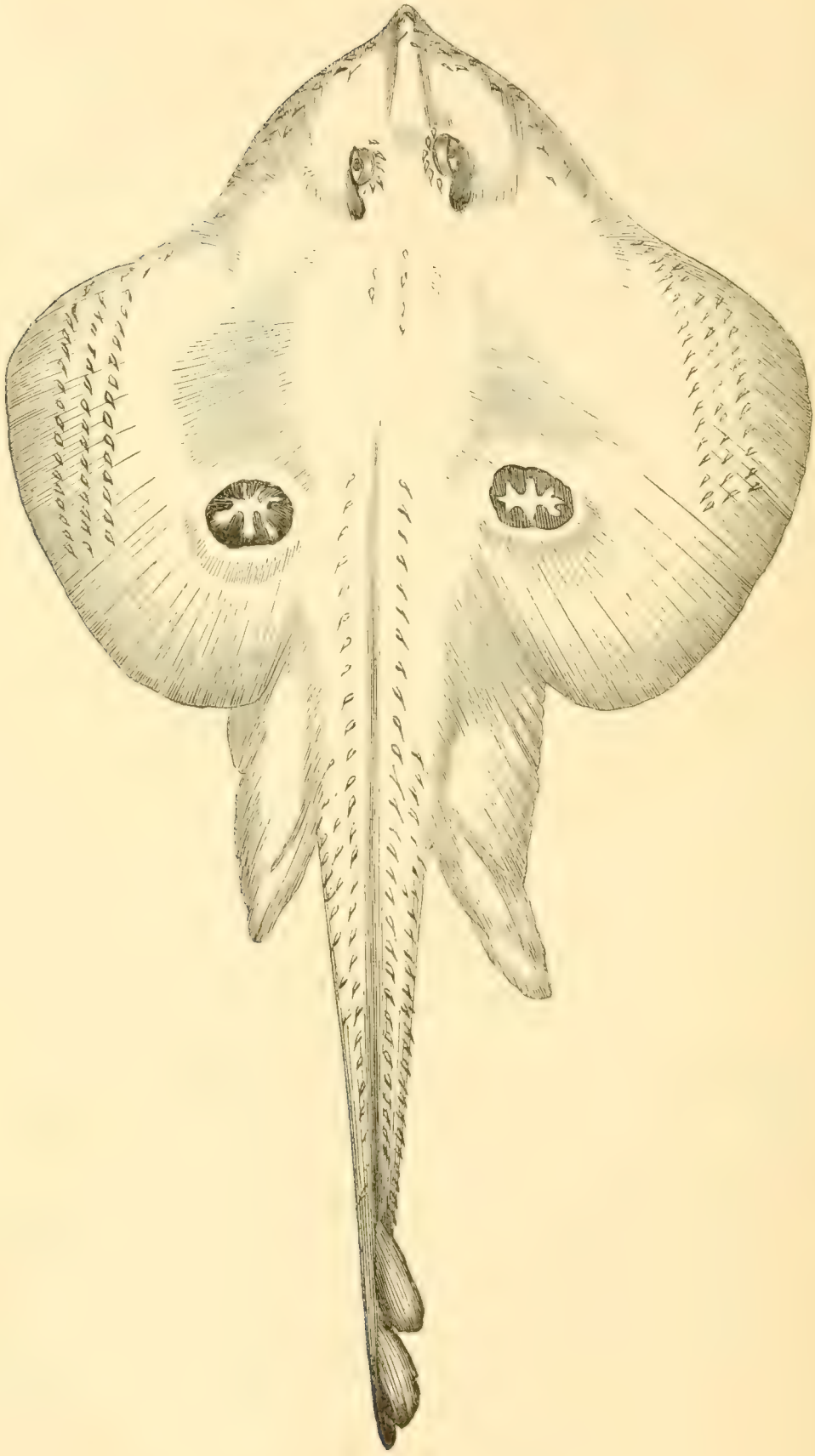
CUCKOO RAY.

each side of this middle space, and a great many smaller spines are scattered on the border. Some spines also near the border of the pectoral fins. The colour pale yellow, and on each side of the disk a well-marked spot of the size of a half-crown; the ground of which black, with defined bright yellow lines or patches.

In another example I found even the fins on the tail covered with a roughness, arising from fine granular spines. The larger spines also were of a fine texture, with a tendency to radiation at their base. A larger specimen, measuring a little more than three feet in length, and which was a female, resembled the above description in most of the particulars, but bore no mark of the beauty-spots on the disk; the tail also was less furnished with prickles on its sides; and, instead of a triangular bed of spines near the head, as in the others, there was one short line of spines, with a single spine on each side of it. Colour of the surface uniformly ash.

The species here described makes a near approach to that which is represented in Mr. Yarrell's "History of British Fishes," vol. ii, page 574, under the name of *R. radula;* but in some particulars the latter differs essentially, as we shall shew when we describe the true Sandy Ray of Cornish fishermen. But it makes even a nearer approach to the species known as the Shagreen Ray; and in the absence of the conspicuous spots on the disk, which, from our description of the large female example, appears to be sometimes the case, there appears to be no way of distinguishing between them, than by the texture of the skin and form of the spines; the former being covered with an uniform blunt roughness, while in the latter the surface is studded with elevated sharp prickles. The spines on the tail also, are, in the Cuckoo Ray, longer and more slender.

This fish is usually found in sheltered bays, and, although of rather small size, it is esteemed as food. The eggs are deposited in December, yet in July I have seen it with eggs, some of which seemed almost ready to be shed.



CUCKOO RAY—MALE.

SANDY RAY.

OWL.

Raia circularis,	Loudon; Magazine of Natural History, new series, vol. ii.
" "	Couch; Cornish Fauna, p. 53.

I can scarcely refer to Mr. Yarrell's figure for this species, as it bears some characters which I am not able to identify. The Sandy Ray is a common species, at least in the west of England, but it is more rarely caught in the winter, perhaps because fishermen do not go at that season to the places it frequents, which are in deep water at a considerable distance from land. It is probable also that it changes its quarters according to the season, for the earliest I have known in the spring have been found at twelve leagues from land. It is disregarded as food, for which the season assigned is, that it does not readily receive the salt for preservation.

The example selected for description measured three feet eight inches in length, of which the tail was nineteen inches; in breadth two feet four inches and a half; projection of the snout three fourths of an inch. The mouth distant from the snout six inches, three inches and a half wide; under jaw peaked in the middle; the teeth slender, sharp, in rows not closely placed; nostrils lobed. Anterior margin of the disk slightly waved, and assuming a circular form, especially rounded off at its greatest breadth, which is at about the middle of the disk. From the snout the ridge is elevated to the eyes, a distance of five inches and a quarter; the eyes two inches apart; spiracles large. The body is thickest posteriorly; tail stout at its origin, rounded above, and tapering; a groove along the body and tail; two fins on the latter, close together.

A few spines near the end of the snout, a line of them behind each eye, five short parallel rows on the middle of the back, the middle row continued obscurely along the groove to the tail, which is covered with stout hooks, scarcely in regular lines; the rest of the body smooth. Colour above an uniform reddish brown, white below. On the disk a variable number of oscellated spots, the size of the section of a large pea; the centre yellow, the border a deeper impression of the colour of the ground. I have counted eight up to sixteen of these spots in different examples, and believe they have no certain number, but they are always situated on each side of the disk in corresponding regularity. I have never found them absent, nor have I ever found the remarkable beauty-spot, which is so common on several species of this family, and forms so conspicuous an ornament on the Cuckoo Ray, on this fish.

SHAGREEN RAY

XXIX

SHAGREEN RAY.

ROUGH FLAPPER. FRENCH RAY. DUN COW.

Raia aspera nostras,	Willoughby; p. 78.
" *fullonica,*	Linnæus. Yarrell; Br. Fishes, vol. ii., p. 578.
" *aspera,*	Fleming; Br. Animals, p. 172.
" *chagrinea,*	Jenyns; Manual, p. 513.

This species appears to be more frequently taken on the coasts of Scotland than on the south or west portions of the British Islands; but it has been obtained in Ireland; and in Devonshire. Mr. William Thompson informs me of its occurrence at Weymouth, and our figure is from an example caught on the south coast of Cornwall; but in the last-named districts it is of rare occurrence. Its peculiar habits, as distinguished from those of other Rays, appear to have been little noticed; but we believe it will be found that the rarer species of this tribe are not more frequently caught, arises from the fact, that the usual baits of fishermen are not suited to their appetite. The snout of this fish projects considerably, and the outline is waved as it proceeds to the extremities of the pectoral fins; the greatest breadth being behind the middle of the disk. The ventral fins are rather narrow; the tail stout and tapering, with two dorsal fins close together near its termination. Eyes rather large, as are the spiracles close behind them. The skin is covered with granulations, which differ greatly from the spines or prickles which sometimes cover the skin of the Thornback Ray or Cuckoo Ray. Our example being a male is better armed with spines than the female may be supposed to be. A row encircles each eye; a lengthened bed of them is on the disk near the widest expansion of the pectoral fins; a line of spines more obscurely

situated at the origin of the back; and a double row of stout spines, with recurved points, runs from about the origin of the ventral fins along the tail to the dorsal fins; in the example described, to the second dorsal. These lines of spines are separate at first, and the surface rounded between them, but they become closer as they proceed. In a female there was the absence of the bed of spines near the borders of the pectorals; but there was a superior amount of roughness at those parts, and from the snout along the anterior border. In the Cuckoo Ray the skin is generally smooth, and the bed of spines behind the head triangular; the spines also being more sharp and slender than in the Shagreen Ray. The ornamental spots so conspicuous in the Cuckoo Ray are also absent.

In a communication from the Rev. Walter Gregor, of Macduff, on the Moray Firth, he informs me that he has only seen one example of the Shagreen Ray in that neighbourhood; which was caught with a line at the depth of thirty fathoms, in the month of February. The total length was two feet eight inches and a half, of which the tail was one foot five inches. The breadth was one foot two inches and a half. When on the beach it threw up its snout and tail almost perpendicularly, at the same time lifting also the pectoral fins.

TORPEDO.

The disk in shape approaches to the circular form, and is plump and soft; the anterior border, unlike other Rays, formed of two slight advances in front, with a small retraction between them. The caudal portion short and stout, ending in a fin which has a lobe below and above. The plump space between the head branchiæ and pectoral fins is occupied by the electrical apparatus; the nature of which has rendered this genus of fishes famous. The surface is smooth; two dorsal fins.

TORPEDO.

CRAMP RAY. TURPAENA. NUMBFISH. ELECTRIC RAY.

Wherever this fish has been found it could not fail to attract attention, by the experience it compelled its observers to obtain of the wonderful faculty which it possesses of affecting with numbness those who handle it—a circumstance which in ancient times must have appeared among the most unaccountable, as it still is among the most surprising occurrences of nature. We find accordingly that the Torpedo and its properties are mentioned by the earliest philosophers whose writings have been preserved; and from them, or popular knowledge, it obtained a name which shews that the nature of its influence had been not obscurely felt. It was from the first called Narké, and, says Oppian,—

"Is rightly named from numbing pain;"

and how generally this knowledge of its powers was spread abroad appears from a declaration of Ælian, B. 9, C. 14; who tells us that he received the account of its properties from his mother, whilst yet a child.

In the year 1774, Sir John Pringle selected this as an appropriate subject for an oration on the occasion of delivering the Copley Medal to Mr. Walsh, in acknowledgment of that

gentleman's experiments on the vital properties of this fish; and we shall be indebted to his narrative and explanation for a large portion of what we shall relate of its early history; but with a larger reference to several other authors who have treated upon it. The first writer mentioned by Pringle is Hippocrates, who, however, only notices it as an article of food; although, as has been justly remarked, by calling it by its significant name, it is shewn that he could not have been unacquainted with its reputation of possessing singular powers. Plato had a like general knowledge of its nature; as is proved by a comparison he causes Menon to make, of his master Socrates to this fish. Aristotle, whose study of nature had drawn him further than any other into an acquaintance with the habits of living beings, and the services their properties secured to themselves, informs us of its habit of lying hid, and employing its peculiar powers for the purpose of benumbing such fishes as might wander near it, and thus satisfying the cravings of appetite. It is probable, from his well-known disposition to inquire into the nature of whatever of interest might fall in his way, that himself had examined this fish, although perhaps only after death; and he must have felt assured from his inquiries, that it truly possessed the properties ascribed to it; for he remarks as something worthy of notice, that so active a fish as the Mullet had been found in the stomach of so sluggish a creature as the Narké. But this eminent philosopher does not appear to have known, or perhaps fully credited, some of the particular facts reported of it; and it was his successor, Theophrastus, who ascertained that the fish was able, when touched by a rod or staff, to diffuse its influence to an object at some distance from itself. This we learn from Athenæus, who informs us also that Diphilius, of Laodicea, discovered the important fact, doubted by others, that the powers of the creature proceeded only from a limited portion of its body; to which Hero of Alexandria added the observation that metals were capable of conveying the influence in the same manner as a rod or staff.

Plutarch should be mentioned next to Hero, since, although probably he did not originally discover it, he is the first to mention the circumstance—that the numbing influence had been known to pass through a net to the arms of the fisherman; and he affirms, what is more fully mentioned by Ælian and other writers,

that if a living fish be placed in a vessel of sea-water, a stream of that water poured on the hand or foot will convey the influence.

Pliny, whose intention it was to bring into a small and convenient compass the whole of the current knowledge of his age, several times mentions the properties of this fish; which, as commander of the Roman fleet on the coast of Italy, he must have seen; but the chief part of what he has handed down to us is copied from other writers. He says, it is to be classed among the cartilaginous fishes, and in its habits shews a consciousness of its peculiar powers; although these powers do not exert an influence on its own body. During the winter it lies hid in some depression at the bottom of the sea, and at other times conceals itself in a soft and muddy place, where it awaits the approach of any fish, which it strikes with the shock when it is off its guard, and then immediately darts upon and seizes it. In addition to what others have said of the numbing influence passing to a distance through a rod or staff, and of inflicting deadness on the most vigorous arm, he adds, that it is able to rivet to the ground the feet of any one, however otherwise active in the race. He goes on to state, that the female produces fourscore young ones at a birth, at the (we suppose autumnal) equinox; and from the manner in which he speaks of the eggs, it would appear that he believed the young to be produced alive: a circumstance in which later observation shews him to have been mistaken. It remained for Oppian to embody the several observations made by others in his poem on fish and fishing; a work in which we can discover the observer of nature, even when the facts related are in great part founded on the authority of more ancient writers. I will remark, however, that he mentions a circumstance that is overlooked or misapprehended by his poetical translator; but which is important as shewing his knowledge of the fact, that the torporific power was seated in a particular part of its body:—

"The Crampfish, when the (hook's dread) pain alarms,
Exerts his conscious skill and powerful arms,
Applies his loins, and bids the line receive
The numbing force it is his will to give.
The flowing influence its volume rears,
Rolls up the slender length of slippery hairs,

Then down the rod with easy motion glides,
And entering in the fisher's hand subsides.
On every joint an icy stiffness steals,
The flowing spirits binds, and blood congeals.
In vain he tries to grasp the sinking rod,
And all his fishing-tackle strews the sod."
B. 3.

At a time when sea and land were ransacked for remedies to cure the various diseases that flesh is heir to, it would have been surprising if the wonderful powers of this fish had not been resorted to; but as a very large proportion of the medical practice of that age was in the hands of those who held themselves out to the public as magicians, and, to use the language of the present day, were at least irregular practitioners of the art of medicine; with whom things the most strange and unaccountable in their effects were thought the most highly of, there is some reason to suppose that the first attempts to turn this energy to use had their origin with them. On this subject we are indebted again to Pliny for most of the information we possess; for recording which, and many others of the prevailing beliefs that had currency among his people, he has been severely condemned, as if he gave credit to the whole. I am of opinion, however, that even a small amount of reflection will prove sufficient to relieve him from the general charge of credulity so commonly brought against him.

At the time when the Roman empire was in its highest grandeur, the larger number of the physicians practising their profession in the city were foreigners, and chiefly from Egypt, a country which then continued to hold the highest reputation for the study of physic and the science of nature; but there does not appear to have existed there, and still less at Rome, any test by which the impudent pretender might be distinguished from the scientific physician; and consequently the boldest assurance might well calculate on achieving the greatest success. A single cure effected on a man of eminence, however fortuitously obtained, was sufficient to bring a fortune to a physician; and the more wonderful the means employed, the greater was believed to be the skill of him who used them. The rational science of Galen or Celsus was less regarded than that laid claim to by one who could employ the secrets of magic and astrology; and where no one was able to disprove

them on grounds which ignorant men of power and wealth could understand, to have omitted the mention of such matters in a work intended to represent the full extent of knowledge then existing in the world, would have been to render himself exposed to a reproach not less severe than, thôugh the reverse of, that so often in modern times brought against him.

But as regards many of the instances of a strange and now incredible kind to which Pliny has given a place in his work, and especially those concerning the Torpedo, he is careful to express or imply his doubts, although as a faithful copyist he feels himself bound to transcribe them. In addition then, to the information, that the local application of this fish was a remedy for some obscure disease of the spleen, we will only adduce one instance of the accepted practice of the magical physicians of that age, reported to us by this writer. It was important that this fish should be caught when the moon was in the celestial sign Libra, and that it should be kept in the open air for three days. If after this it were simply brought into the room where a woman was in a state of parturition, it would secure her speedy safety; and it would appear that it might thus be carried from one patient to another with equal success.

The first physician of real abilities who directed his attention to the study of the medical properties of this fish was Galen; who prescribed the application of the living fish to cases of periodical headache with much success; and we learn also from Scribonius Largus, quoted by Matthiolus in his Commentary on Dioscorides, that a freedman of Augustus Cæsar was relieved or cured of a fit of the gout by the same means. But it is not a little remarkable, and suggests some doubt of this supposed instance, that this case, which from the eminent station of the patient, must have been widely talked of, was not known to Pliny or Celsus; careful as the former has shewn himself to have been to collect all the information on every subject then attainable, and well acquainted, as he may be supposed also to have been, with all that was of interest connected with the court of Augustus. And how little the true nature of this remedial influence continued to be understood, appears from the writings of Paulus Ægineta, himself a physician of eminence; but who knew so little of the source of this powerful

emanation, that he gives the prescription of an application, called Torpœna from a then common name of the fish, which was to be kept ready prepared for use. It was formed by boiling the flesh of the Torpedo in oil until its whole substance was dissolved and mingled with it. That even Galen supposed the existence of some of its properties after death is rendered probable by his remark, that when used as food it rendered the body dull and stupid.

For more than a thousand years such was the extent of the knowledge of nature possessed even by those who were the most intimately acquainted with its phenomena; and it was only when the properties of electricity had become the subject of experiment, that any further light was thrown on the peculiar powers of this fish. The discovery in a distant land of a fish of a very different species, but which was endued with similar faculties, had given a new impulse to inquiry; and it was then recollected that the powers of the Torpedo had never been closely studied. Redi, an Italian physician, was among the first to make remarks on the living fish, and Mr. Walsh the most successful of those who instituted experiments; and it is with a short account of these, accompanied with an abstract of the anatomical examinations of the illustrious John Hunter, as contained in the Lectures of Professor Richard Owen, that we shall close our history of these properties of the Torpedo.

Redi says, that in order to satisfy himself of the certainty of the things reported about this fish, he repeated his observations on more than one example; but more particularly on a female of the weight of fifteen pounds, which had been caught for his use, and brought directly to him from the sea. As soon as he had grasped it with his hand, the hand and arm up to the shoulder began to suffer a creeping sensation, as if emmets were passing over it, accompanied with a trembling so irksome, and increasing to such sharp and tormenting pain at the point of the elbow, that he was compelled to remove his hand from the fish; and when he again attempted to grasp it the painful sensations returned. He remarked, however, that as the vital powers of the fish decreased, its power of inflicting pain and trembling also grew less.

This fish continued alive for three hours, and on dissection its heart was found to beat for seven hours afterwards; but

he remarked that after death no other sensation proceeded from it than might come from any other fish. Redi made the trial of placing his hand in the water in which the fish lay, but without feeling any inconvenience; as might be expected if the fish were not irritated. This author detected the existence of what we now know to be the electric organs; but he failed to understand their mode of operation, and supposed the columns to be of the nature of muscles.

The operations of Mr. Walsh were conducted under more favourable circumstances, in consequence of the discoveries that had been lately made in the science of electricity. The substance of them was, that the fish possessed the power of accumulating in its electrical organs a considerable amount of that fluid, much in the same manner as it is accumulated in the instrument called the Leyden phial; so that while one of its surfaces, the back, was in the positive condition, the belly was negative; and the equilibrium could be restored by the interposition of water, metals, or the human body. Besides the degree of pain and numbness inflicted by this voluntary discharge on the part of the fish, under the influence of its will or passion, its violence can be judged by what is reported by Lacepede: that a duck was presently killed by being exposed to the shock. In Mr. Walsh's experiment a Torpedo was laid on a table, where it rested on a wet napkin. Five persons, insulated, or separated from any connection with a conducting substance, stood round another table; and two brass wires, each thirteen feet long, were suspended by silk strings from the ceiling of the room. One of these wires rested by one of its ends on the wet napkin, and the other end was immersed in a basin of water placed on a second table; on which stood four other basins, also full of water. The first person placed a finger of one of his hands in the water in which the wire was immersed, and a finger of his other hand in the second basin; and so on successively until all the five persons were brought into communication with one another by means of the water in the basins. One end of the second wire was dipped into the last basin of water, and with the other end Mr. Walsh pressed the back of the fish; at which instant the whole of the five persons were affected with the shock. Nothing could have been more decisive, even if the electric machine had been itself employed.

These electric organs are two-fold, and one of them is lodged on each side of the head and gills. They are formed of very numerous perpendicular pyramids, the ends of which are covered by the integuments clothing the back and under part of the body. Each column appears like a mass of clear jelly, but on close examination it is seen to be formed of membranous plates, fastened at their margins to a case or capsule; and each one separated from the next by a small quantity of albuminous fluid. Each cell thus formed has its own separate lining, and the covering which encloses the whole forms the seat on which the blood-vessels and nerves, supplying this organ with their special fluids, are spread abroad, before they enter to execute their specific functions. The blood conveyed thither is of the purest kind, and the nerves are such as are well fitted to convey a very large supply of their proper influence; the first four of them being as large as the spinal cord itself, from which all the other functions of animal life are bestowed on the body. As no other special function resides in the pectoral fins, and the general perceptions of the Torpedo are dull and inactive, it is to be concluded that these nerves supplying the electric organs are formed thus large, for the sole purpose of conveying the required energy from the nervous centre, where it is prepared, to the mass of cells; the proper function of which is to accumulate and retain it, until the instinctive feeling of the fish shall cause it to be discharged, either as a weapon of defence, or to supply its need, in the disabling and capture of its prey.

The ancients possessed but little discrimination in detecting the smaller differences which mark the distinction between nearly allied species of any kind of creatures; and they were further prevented from assigning to those differences any important value from the general opinion of philosophers, that variations from a known type of form were to be ascribed to a kind of bastardy, arising from the indiscriminate conjunction of the sexes of kindred kinds. It is in modern times only that the last-named supposition has been judged unsound; and we owe it to naturalists of late date that we are able to assign what is known of the variations of the Torpedo, as it is found in the seas of Europe, to two separate species, with the probability that there may also be a third.

At first the attempt to apportion to those supposed species their true distinctive characters was built upon an attention to the remarkable spots, usually five in number, which are often placed in regular order on the surface of the disk; the absence or orderly arrangement of which was supposed to constitute the definite mark of a species. But it has been found by observation that in fishes in other respects closely resembling each other, these spots, as well as the general colour of the surface, are exceedingly liable to vary; and that in many cases, and especially in those found on our own coasts, they are usually found wanting; and it is further said that they commonly do not occur in young examples. More extended inquiry may shew that when they occur these spots are more frequent in one species than another, or that when present their arrangement may be specific; but these particulars, so far as they are now known, are attended with so much uncertainty that, setting all others aside, I shall confine myself to a single one, which, in our present state of knowledge, appears the least liable to uncertainty; and according to which I form the following arrangement or references:—

Cramp Ray, with a fringed border to the spiracles, the fringes described as from six to ten in number.

Torpedo narké,	Cuvier.
" *vulgaris,*	Jonston; Tab. 9, f. 3, 5, 6.
" "	Willoughby; as described.
" "	Bloch; pl. 122. Donovan; pl. 53.
" "	Risso; pl. 3, f. 4 and 5. T. marmorata and T. Galvani. Torpille vulgaire.
" "	Fleming; Br. An., p. 169.
" "	Jenyns; Manual, p. 509.
" "	Yarrell; Br. Fishes, vol. ii, p. 543.
Raie Torpille,	Lacepede; who speaks of it as having *sometimes* a fringed border to the spiracle, as if this were liable to uncertainty.

Cramp Ray with plain spiracles.

Torpedo Galvanii,	Cuvier. Jonston; Tab. 9, f. 4.
" "	Willoughby; T. D. 4. The tail badly represented.

Torpedo Galvanii,	Risso; pl. 3, f. 3. Une tache. T. unimaculata.
" *nobiliana,*	Yarrell; vol. ii, p. 546. Walsh's experiments were made on this species.

Although the figures of these fishes in books of Natural History are in general sufficiently characteristic, there have usually been defects, the cause of which may properly form a portion of their history.

It is only for a short time after the fish has been taken from the water that the disk preserves its shape and dimensions. Soon after death a shrinking takes place on the upper surface; by which the plumpness of its appearance is diminished, and the borders become contracted; so that the lower surface gradually curls upward, and occupies the margin to the extent of several inches. But if it happen that the body has been placed in a position by which its parts have sustained a strain, the proportions become stretched into an unnatural shape, much unlike that which it bore when alive. Risso's figures appear to have been drawn from examples which had been thus dealt with; and although boasted of by him, are by far the worst anywhere to be found. The particular changes thus referred to are noticed by Mr. Dillwyn, in his "Fauna of Swansea:" —"When alive the length was found to be forty-one inches and a half, the greatest breadth twenty-nine inches and a half; the breadth of the caudal fin at its extremity nine inches, and the weight above forty-four or forty-five pounds. On the following day it measured forty-two inches by thirty, and it then weighed forty-three pounds and a half. In stuffing the specimen the length, to my surprise, has considerably increased, though the other dimensions remained nearly unchanged, and now the extreme length is forty-nine inches; the upper lobe twenty-four inches, the lower lobe ten inches and a half, the tail eight inches and a half, and the caudal fin six inches long. The breadth or greatest diameter of the upper lobe is thirty inches, and of the lower lobe fifteen inches, and the caudal fin has contracted at its extremity to be only eight inches broad."

Our description is from an example taken in a trawl a little on the outside of the Breakwater in Plymouth Sound. The length two feet six inches; form of the disk nearly circular;

the front almost straight, except that it slightly recedes at the place where the snout is usually found slightly projecting in the family of Rays; and a small projection is to be discerned at the border opposite each eye. The thickness and plumpness of the body extend to near the circumference. The eyes small, and embedded in the surface, so that the sight appears directed upward; but they do not strictly answer to each other. Spiracles oval, simple, a corner directed obliquely forward. The right ventral fin passing a little further back than the left; side of the caudal portion having a ridge. The first dorsal fin at the part where the caudal portion joins the disk, at the end of the ventrals; second dorsal a little behind the first, and smaller. Tail with a lobe below and above, the edge of the lower portion passing a little further forward than the upper. The mouth small, arched, the teeth sharp, and moveable, from the loose condition of the membrane on which they are placed; the jaw-bone slight and feeble. Nostrils nearer the sides of the mouth than in the Rays generally; connected to each other by a loose fimbriated curtain, which has a deeper notch in the middle. Colour dark brown, with a tinge of blackish purple; a lighter brown margin round the eyes. It was a female.

Examples of this fish have been obtained in different parts of England and Ireland; and we may suppose it is only because fishermen do not often resort to the slimy and unproductive places it frequents, that it is not much more frequently caught. Five were noticed in one year in the Mount's Bay, in Cornwall; two or three came under the observation of William P. Cocks, Esq., of Falmouth; and an example was obtained at Weymouth, by William Thompson, Esq. A specimen has been seen that weighed a hundred pounds; but it is to be remarked that the spots which were so conspicuous in these fishes in the Mediterranean, have not been noticed with us. A snout, however, was discernible in one or two, at least, which were obtained in the Mount's Bay.

Torpedo's Teeth, enlarged size.

TRYGON.

The head enclosed on the sides by the pectoral fins; the body elevated; tail slender, without a fin, armed with a long spine, which is serrated on the edges.

STING RAY.

FIRE FLAIRE. TRYGON.

Pastinaca marina,	Jonston; p. 32.
" "	Willoughby; p. 67, pl. C. 3.
Raia Pastinaca,	Linnæus; Donovan; pl. 99.
" "	Bloch; pl. 82. Jenyns; Manual, p. 518.
Raie Pastenaque,	Lacepede. Risso; p. 10.
Trygon Pastinacea,	Fleming; Br. Animals, p. 170. Cuvier.
" "	Yarrell; Br. Fishes, vol. ii, p. 588.
" "	Gray; Catalogue Br. Museum, p. 118.

The ancients were well acquainted with this fish, and had an extravagant dread of what they supposed the poisonous effects of a wound inflicted by the dart on its tail. There is no doubt that this may be the cause of considerable injury when dashed about in all directions, by the vibration of the tail of an angry fish; and it is not improbable that a formidable inflammation would follow; and even that an attack of tetanus or lock-jaw has been produced in a constitution of body already prepared for such consequences. Such a superstition is countenanced by what Matthiolus says, in his "Commentaries on Dioscorides," of instances where death from the wound has been attended with convulsions and contractions of the whole body. He also quotes Ætius as saying that such wounds are soon followed with severe pains and deadness, which spread over the whole body. It is, therefore, with some truth that

STING RAY.

XXXI

Pliny remarks how much the poisonous effects of such an injury are to be dreaded.

But the ancients had not learned to distinguish between those effects of an injury, which for the most arise from diseased influences existing in the person who suffered, and those produced by a poison inserted into a wound from the instrument inflicting it. The bite of the adder is of the latter kind; but observation has not confirmed the opinion formerly so widely spread, of the poison communicated by the dart of the Sting Ray; the injury from which is more properly ascribed to the jagged nature of the wound scattered over a broad surface of the skin. The firmness of the structure of this dart forms also a material portion of its powers; for the numerous points along its sides are in a reversed direction; so that when it has penetrated the flesh it cannot be withdrawn without the enlargement of the wound.

A narrative given by Ælian will shew some of its formidable effects from this cause, and also afford another explanation of the greater terror felt concerning it, where the people were generally ignorant of natural phenomena. A man had contrived to filch away from the net of a fisherman a Sting Ray, which he had mistaken for a Turbot; and which he hastened to sell in the market. It was concealed under his clothes; and feeling some uneasiness in the part of his body where the fish lay, he pressed it so much the closer. The story appears to shew that in his haste he fell to the ground, by which accident the dart was driven into his body; for he was found dead, with the dart piercing to his bowels, which protruded through the wound; and by this circumstance, in the opinion of the people, the fatal nature of this instrument became still more positively confirmed.

We need not feel surprised at finding poetry and romance uniting their powers to spread abroad the opinions and feelings thus existing in the public mind; and accordingly the brief notices recorded by Pliny are thus expanded in the poetry of Oppian; in his account of which he unites the Sword Fish with the Sting Ray:—

> The Fireflair's tail its venom'd shaft contains;—
> Nor time, nor waste the poisonous treasure drains.

Murderous alike they ravage all the sea,
First give the mortal wound, then seize the prey.
In this they differ; when the Sword Fish dies,
Extinct with him the mouldering weapon lies.
Not so the Fireflair's dart; that still survives
The dying fish, and in its venom lives.
None equal that the Ray-like Fireflair bears;
No dreaded stroke, no killing wound like hers.
All things must yield; the dire infection's such,
The solid flint would moulder at the touch.
When rising shrubs their spreading branches shoot,
Pride in their leaves, or joy in ripening fruit,
If with the Fireflair's spear the hand unkind
But grate the root, or prick the tender rind,
The leaves shrink in and all the glories fade,
Rich sap no more is through the pipes convey'd;
No kind supplies flow round the porous stem,
Cast a bright green and swell the smiling gem,
But killing juices all the fibres taint,
And tarnish'd verdure tells the fatal want.

Ælian says that such a wound was beyond the reach of remedy; but we find it prescribed for, and even with remedies that could have possessed but little of the powers of healing. And with all the fear which existed concerning it, it appears surprising that there were people bold enough to employ it for the purpose of enabling children to cut their teeth the more easily. When reduced to powder it was believed also to have the power of relieving the tooth-ache, and of finally causing decaying teeth to drop from their sockets. Nor, with some explanation, is this last prescription so entirely useless as at first sight might appear. The powder was mixed with that of white hellebore; and if medical writers of no mean credit are to be believed, this vegetable preparation is really possessed of the virtues ascribed to this composition; and it was a popular empiric application in the middle ages.

The Sting Ray is not a common fish in England; but it is scarce rather than rare; and mostly perhaps because the swampy places it frequents are not usually resorted to by fishermen; besides which it does not often take a bait. It has been supposed that the dart is of some use in obtaining its food, which appears to be small fish. By some, especially in remote times, this fish has been commended for the table; but Risso speaks unfavourably of it.

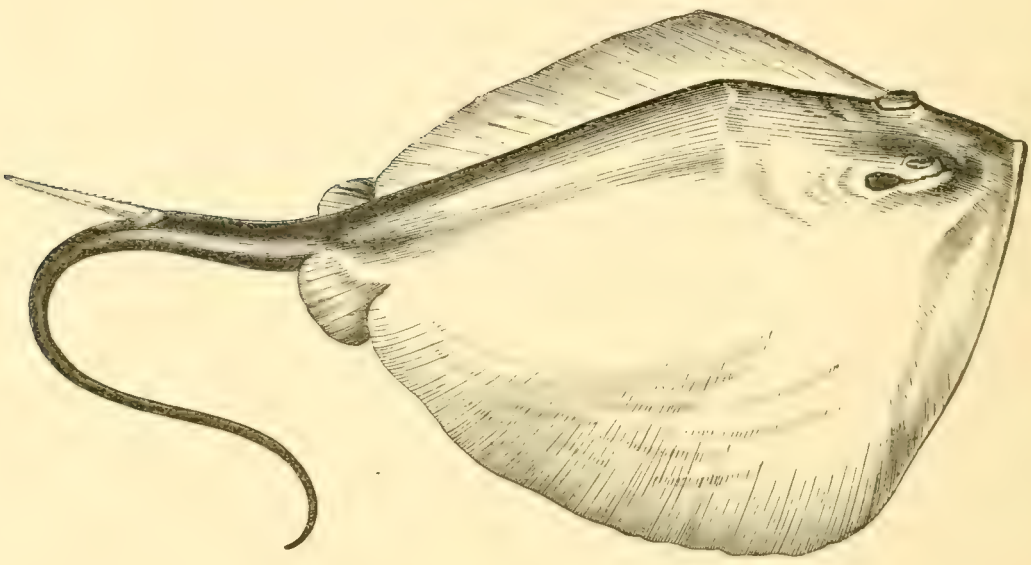
The length of the specimen described was thirty-one inches and a half, the tail measuring sixteen inches; the greatest breadth

nineteen inches; the snout short, thin, and a little turned up; from it to the eye three inches and a half; the eye rather small, and prominent; spiracles large, and passing forward under the eye. At about the middle of the body it is much raised, and from that part it slopes both forwards and behind; the widest part at about six inches and a half from the snout, and consequently before the middle; ventral fins nearly square posteriorly. The tail thick and round from its origin to the place of the spine, and from thence slender. Root of the spine five inches and a half from the origin of the tail; the spine five inches long, lying lengthwise; moderately sharp, grooved in several lines, with a keel below, armed along each side with a close-placed row of reversed points. A deep depression along the middle of the back of the tail from its origin upwards—there obsolete; two others on each side of the root of the spine, passing up to the cross bones not far behind the eyes; which lines, although fainter than the middle line below, are more strongly marked above. The skin smooth; mouth and teeth small. In one example the general colour was a dark red, in another dusky yellow.

It is a wise provision in the œconomy of nature, that when the dart has become blunted or otherwise useless, provision is made for its being restored, by a loosening of its root of attachment, when it drops off, and is replaced by a new one. Whether this is done periodically, or at irregular intervals, is not known; but it sometimes happens that the newly-formed spear is well advanced in growth before its predecessor is thrown off, and an instance of this sort enables us to remark that both had their origin from the same root or gland. The older spear was the longer, being seven inches long in a fish the extreme length of which was three feet, hanging rather loosely; while the new, which protruded under the other, closely adhered for half an inch, and was of softer consistence near its root. Professor Owen refers to Agassiz, as pointing out the close resemblance of the microscopic structure of the bone of this spine or dart, and the dentine of the teeth of the same fishes; they are both hardened by an outer layer of modified dentine, but as hard as enamel.

Mr. Dillwyn (Fauna of Swansea,) mentions an instance of the occurrence of two spines in a Sting Ray caught near

Swansea; and supposed it, therefore, to constitute the *R. altavela* of Linnæus. But it is probable that he quoted from memory; and the much rarer *R. altavela* is distinguished by not having a fin on the tail. It has never been found in England.



Sting Ray, shewing the raised part of the body.

MYLIOBATIS.

The head projecting beyond the attachment of the pectoral fins; the latter spreading wider than in other kinds of Rays. Jaws with broad flat teeth. Tail long and slender, bearing a single dorsal fin, and armed with a spine.

EAGLE RAY.

TOAD-FISH. SEA EAGLE.

It was called the Eagle in ancient times, because of its widely-spread pectoral fins resembling wings, and its great magnitude when of full size; its weight being supposed to amount to several hundred pounds. It was also named Toad-fish from the appearance of its head, which slopes considerably, and its protuberant eyes on the sides of the head; conveying, therefore, the impression of the aspect of that reptile.

Myliobatis aquila,	Jonston; p. 30, tab. 9, f. 9.
" "	Willoughby; p. 64, tab. c. 2.
" "	Lowe; Fishes of Madeira, tab. 15.
" "	Jenyns; Manual, p. 519.
" "	Yarrell; Br. Fishes, vol. ii, p. 591.
" "	Cuvier.
Raia aquila,	Linnæus.
Raie aigle,	Lacepede and Risso.

It has been the general opinion of naturalists that this fish produces its young alive; but in the year 1845, Charles William Peach, Esq., then living at Fowey, in Cornwall, obtained from the master of a trawl vessel belonging to that port, a large and very curious purse that had been dredged up in his trawl, and presented it with its contents to me, and from which was extracted an undoubted example of the partially developed young of the Eagle Ray. This purse is described below, and the embryo within it appeared to be about half developed, with

the ovum attached to its body; and threads or fibres projecting from the orifices of the gills; such as are known to exist in the Sharks and Rays, and indeed also in toads, frogs, and water-lizards, in the early stages of their existence; but which in the former disappear when their functions are no longer needed, considerably before they are thrust upon an independent existence. The spine on the tail had not yet made its appearance. I have received by the kindness of a gentleman in Dorsetshire, another purse of the same sort, obtained on the coast of that county; a further proof that this fish is not so rare a visitor as has been supposed.

Besides the above proof that this fish produces its young by means of purses instead of producing them alive, the circumstances here related also shew that it is not merely a rare visitor to our neighbourhood; and of this also the following incident furnishes evidence; for that it refers to this species I feel no manner of doubt:—A fisherman, long and well acquainted with the fishes of the British seas, and especially with all our common sorts of the family of Rays, informed me that in the month of July, whilst at sea, his attention was attracted to a fish which was swimming close to the surface, when the sea was smooth and the weather fine. Its general appearance was that of the Ray kind, but with a particular aspect, which on closer inquiry clearly answered to that of the Eagle Ray; the eyes especially attracting his notice, as at the side of the head, and resembling those of an ox. When he approached it for examination, the boat passed over it, and in doing so inflicted a violent blow, which caused the fish to turn almost over in the water; but it presently set itself right again, and moved heavily onward. He laid hold of it with the boat-hook; but the weight, which, on comparison with the Skates, he judged to be not less than three hundred pounds, was too great for him, and he was obliged to resign the task, and he finally lost sight of it; but not by the sinking of the fish, for it continued near the surface until the boat had passed to leeward out of sight.

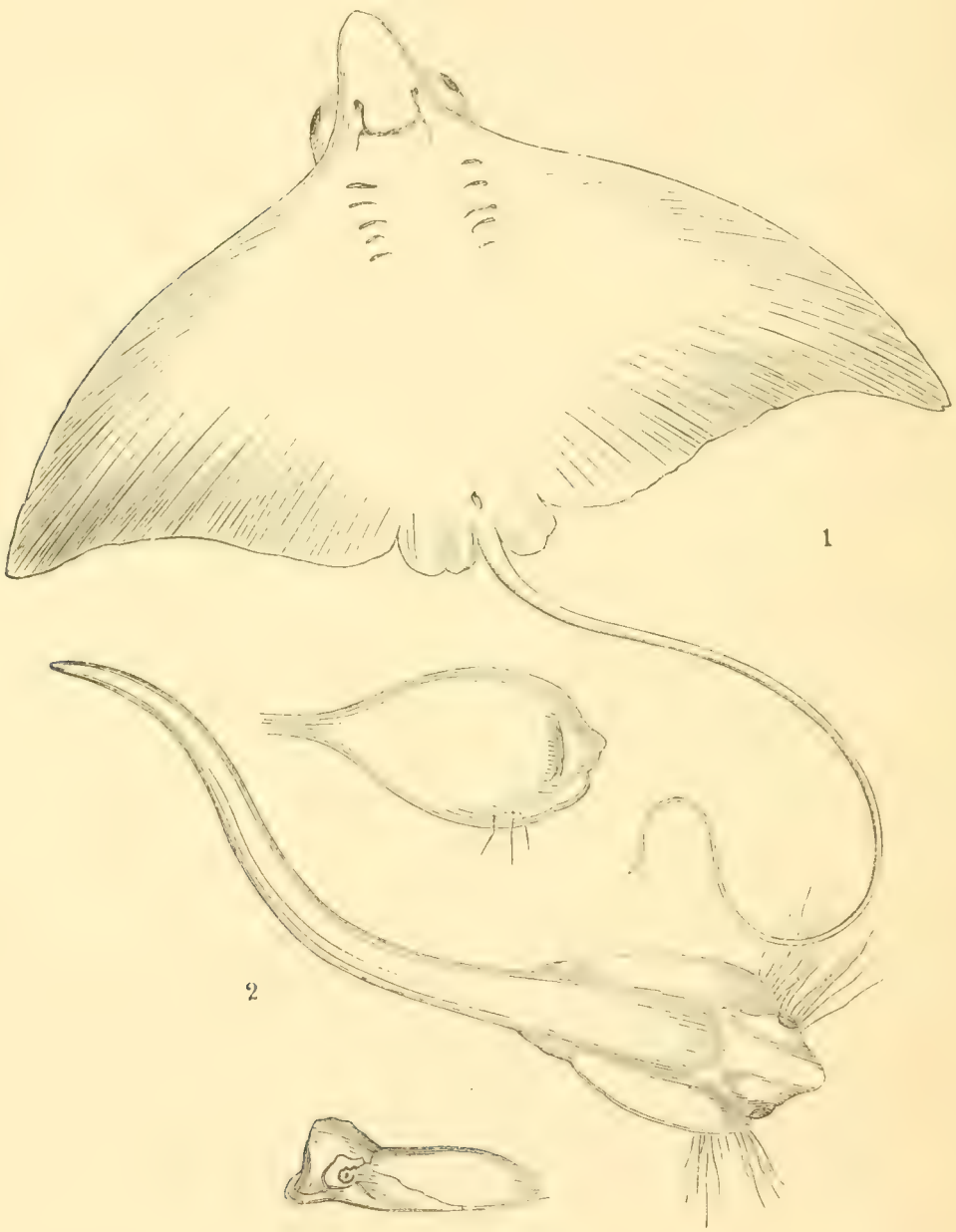
The incident here related shews the fish to be of dull and sluggish habits; but that it is not so great a stranger as has been supposed even on the north of British coasts, appears from the fact, that an example was obtained by Dr. George Johnston, in the neighbourhood of Berwick.

I prefer to take our description, but in an abbreviated form, from Mr. Lowe's unfinished work, the "Fishes of Madeira," rather than from an imperfect specimen obtained in England; and the rather that the former was derived from an example fresh from the sea, and not from one preserved in a museum.

The pectoral fins are widely spread, and growing narrow at their greatest extent; the back raised, and so sloping to the snout, and also towards the tail; which organ is long, slender, and ending in a fine point, with a fin near its origin, and a dart or spine having reversed serrated teeth at the sides, not far behind the fin. The eyes are large and prominent, on the sides of the head, under a projection of the bone, and close behind them wide spiracles. The posterior border of the pectoral fins incurved and waved; ventrals small, and the claspers of the males so small as to be nearly concealed by these fins. Mouth below, level with the origin of the pectoral fins; the jaws with flat grinding teeth in the middle, but none at the corners of the mouth. The general surface is smooth, but there is often a roughness from the head along the back, and spreading a little over the base of the wings. The length of the tail is about twice the length of the body, and rather exceeding in its extent the whole breadth across the pectoral fins. The colour is greenish or olive liver brown; the tail dark brown, beneath white. When first taken this fish flourishes its tail in all directions; and although the tail is proportionally less than in the Sting Ray, it is capable of inflicting formidable injury. The length of the purse is six inches and a half; the breadth four inches and five eighths; length of the longest tendrils about seven inches and a half, flat and thin in shape, and ending in a slender cord. The structure of the surface is curious and beautiful, differing much from that of other known Rays; the surface thickly set with raised longitudinal lines, closely crossed with dots or raised lines; each longitudinal line being thickly studded with raised markings, points, or short lines; which, however, do not pass from one line to another, although they appear to sink into the minute channel between them. This description, however, only applies to the middle of the case; for towards the ends and sides the longitudinal lines are joined in this manner, and the reticulations form

beautiful squares, which grow finer towards the border, and disappear at the margin. Colour approaching to black.

Our figure is copied from the work of Mr. Lowe, just referred to.



1.—Eagle Ray. 2.—Embryo of the Eagle Ray, taken near Fowey.

PTEROCEPHALA.

The fore part of the head as if cut short, and the pectoral fins, instead of clasping it, have each of their anterior extremities extended forward, appearing as if the fish was furnished with horns. The tail slender; the spine, dorsal fin, and pectoral fins broad.

OX RAY.

Cephaloptera Giorna,	Cuvier? Jenyns; Manual, p. 519.
" *Masséna,*	Risso; Vacca?
Raia Fabroniana,	Lacepede.
Horned Ray,	Yarrell; Br. Fishes, vol. ii, p. 595? the figure we must suppose, unlike anything in nature.
" "	Professor F. M'Coy; Annals and Mag. of Natural History, vol. xix, for March, 1847.

This remarkable form of the family of Skates and Rays attracted the forcible attention of the ancients, as well from the enormous size they have sometimes attained, (even to twelve hundredweight or more,) as from the singular form of the front of the head, which, from its resemblance to a pair of projecting horns, gave occasion to their being characterized by the name of Bos, or the Ox. In the present day on the coast of Italy, according to Risso, they are known by the name of Vacca, or the Cow. A large example, which, whether specifically different from the smaller individuals that have come to our coasts is uncertain, was the terror of the divers for sponges and coral; for whom it was supposed to be ever on the watch with devouring propensities, and whose return from the bottom it endeavoured to intercept by assuming a station at mid-water above them, where it so molested their endeavour to ascend, as to cause their destruction; of which

proceeding the following verses of Oppian contain the popular belief, referred to also by Pliny, B. 9, C. 70:—

Enwrapt in softer slime the Sea Cow dwells,
Who every sea-bred kind in breadth excels.
To twice six cubits stretched, their flatted sides
Press down the lab'ring waves and smooth the tides.
Unarmed their body, though with monstrous size
And bulky form they strike the wond'ring eyes.
Borne on the struggling floods that broad-backed Ray
Unwieldy lolls, and takes up all the way.
Few are their teeth, unfit for martial toil,
Thin set, not made to seize the doubtful spoil.
But schemes well laid they resolute pursue,
And by superior fraud ev'n man subdue.

They mark when daring mortals plunge below,
Where pearls are hid and coral branches grow;
Then hover o'er the place and float at ease,
Stretch on the waves and shade the covered seas;
With patient hope unmov'd their station keep,
Till from the secret chambers of the deep
Laden with spoils the diver mounts again,
Nor can the surface reach with all his pain.
By wonted arts he tries himself to raise,
But o'er his head th' unwelcome pressure stays.

Kept back from looked-for day, the mortal grieves,
In vain the pressing lid his shoulder heaves;
His weaker thrust the stubborn weight withstands,
And backward sinks him down to lowest sands,
If he swims forward, and the surface leaves,
The subtle fish the vain attempt perceives,
Still hangs aloof, and o'er his pensive head
The shades unwish'd their gloomy coverts spread,
Till wearied arms their toilsome work refuse,
But faintly strike, and catch the yielding ooze.

Such is the toil when venturous divers meet
The floating roof, and push the pressing weight.
Stretched on the watery plain unmoved it lies,
And open air and lightsome day denies,
Till swallow'd waves an easy passage find,
And in its latest breath life mingles with the wind.
Thus, proud of her success, the spreading Ray
By stratagem obtains the noblest prey.

B. 2.

Into what species this family of fishes may be divided appears even now to be uncertain, and British naturalists not only differ from each other, but from themselves, in those descriptions and accounts which seem necessary to enable us to form definite opinions on the subject. Of the few examples which have been taken in the British seas there is little certainty, since they have not generally come into the hands of competent observers; and some of the engraved figures appear

to have been derived from badly-preserved, and even mutilated subjects. It appears highly probable, however, that more than one species has visited us; and, in collecting together what has been recorded concerning them, I would be considered as furnishing the reader with a summary of what is known, for future use, rather than as satisfying inquiry or advancing a decided opinion. I have not myself been able to examine and sketch more than a single example, and that a preserved skin, of these fishes, and this I believe to have been obtained from the Mediterranean; but, although with some difference, it bore so close a likeness to the example described and represented by Professor M' Coy, in the "Annals and Magazine of Natural History," already referred to, that I feel no hesitation in believing them to represent each other. Professor M' Coy's description is therefore here brought forward at considerable length, and his figure is chiefly depended on, although another is also produced, from the example already mentioned as sketched from nature by myself.

"The specimen in question was first publicly noticed by Mr. Thompson, in a communication to the Zoological Society of London, and the particulars which he gives of its capture on the Irish coast are all I know on that point. That gentleman, however, neither described nor figured the specimen, merely noticing its general resemblance to the figure given by Risso of the *Cephaloptera Giorna;* subsequent writers seem to have in some measure mistaken this passage, as they make the reference to that species decisive, which, as I have stated, was not the case in the original notice. I might here suggest, that, according to the rule of priority, Dumeril's name *(Cephaloptera)* should not be retained for this genus, having been previously used by Geoffroy St. Hilaire for a genus of *Coracinæ,* formed for the reception of that remarkable bird the *Coracina cephaloptera* of Vieillot. It has been proposed to alter the name of the genus of fish to *Pterocephala,* which it would be well to adopt.

"On examining this very interesting specimen, I found that although obviously a *Pterocephala,* it yet presented most important differences from the *C. Giorna,* both in outline, proportions, shape of the fins, and form of the wing-like appendages to the head; neither does it agree with any of the European

or American species described by modern writers, so far as I have seen, but seems referable to that described many years ago, from the coast of Tuscany, by Dr. Fabroni, of Florence, and figured by Lacepede under the name of *Raia Fabroniana*, in honour of its discoverer. This species seems to have been lost, Cuvier and most other ichthyologists throwing a doubt on its existence, and supposing the figure referred to to represent a mutilated example of the common *C. Giorna;* it is therefore doubly interesting to re-discover it in our own seas, as an addition to the fauna, and as re-placing an old species in the systems. The *P. Fabroniana* differs from the *P. Giorna* in the length of the body (exclusive of the whip-like tail) being nearly one half of the width from tip to tip of the pectoral fins, while the length is not more than one third of the width in the latter species. Besides this great proportional width of *P. Giorna*, its pectorals are much narrower than in the present fish, and nearly straight; while in the *P. Fabroniana* they are broadly falcate, recurved, and without any fan-like margin on the anterior edge. The appendage to the head forms a semicylindrical process in the *P. Giorna*, but forms two horn-like fins, one on each side of the head, in the Irish fish and in Fabroni's Mediterranean one. Those are represented in the figure sent to Lacepede, and engraved in his work, with, I think, rather too many turns, being twisted into regular conical horns; the corresponding parts in the specimen under consideration shew also a strong tendency to roll spirally, but not amounting to more than I have represented in the sketch; this is, however, a matter easily exaggerated by an artist, or the difference of age or sex would very probably make a difference in the length and consequent enrolment of those parts.

"Dr. Fabroni's species is defined as a falciformly dilated brown Ray, whitish beneath, etc. This colouring agrees exactly with our specimen, but differs entirely from that of *P. Giorna*. Another point of agreement between the two former specimens is the extreme slenderness of the tail, it not being more than half the thickness of that of *P. Giorna;* the tail in both specimens of the *P. Fabroniana* is defective as to all that portion from the barbed spine to the tip, so that the exact position or form of the spine is unknown. The figure

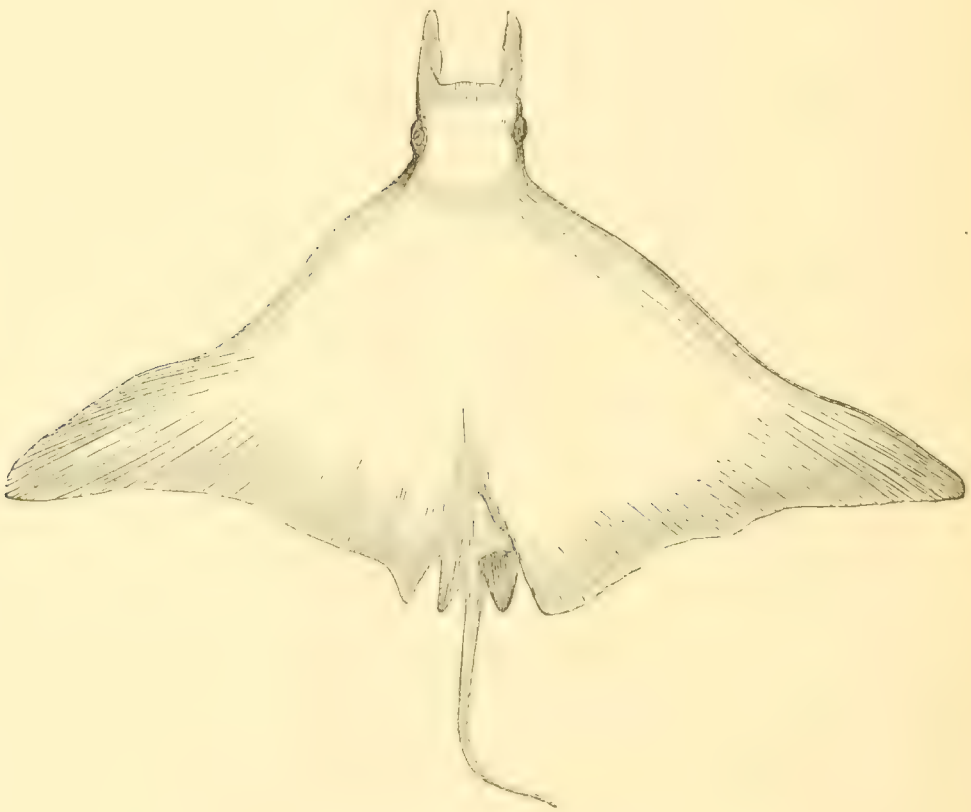
given by Lacepede is of the under side only; it agrees, however, very well in the general form and proportions, broad, recurved pectoral fins, frontal processes, and the small size of the tail. There is a very strong resemblance also between the present fish and the Indian *C. Kuhlii*, as figured by Müller and Henlé, particularly in the form of the lateral processes of the head, and the general proportions of the body; but our specimen and Dr. Fabroni's seem to differ from that species in the small size of the head, and some minor points, in addition to the difference of habitat.

"Length of the Irish specimen from the front to the dorsal fin one foot eight inches; entire width three feet eight inches and a half; height of the dorsal fin two inches and a half, length the same; from one eye to the other eight inches."

For the sake of brevity I will take from the accounts of Lacepede and Risso only as much as may serve to afford a proper understanding of the nature and uses of the remarkable processes which have been compared to horns, and which form the principal portion of the character of this tribe of fishes, the employment of which appears to constitute a highly curious portion of their history. In the example described by Lacepede those processes were slender, moveable, and upwards of eighteen inches in length, thus measuring about a fourth part of the whole length of the body of the fish. They are formed of ribs of cartilage bound together with a membranous substance, so moulded as to be capable of being spread out like a fan, a structure which serves as well to enable the fish to feel its way, as to convey food to its mouth. Risso describes these processes in the recent fish as being whitish on the inside, tinted with blue on the outside, and very black at the extremity. It appears to have the power to unroll these processes at will, and to direct them towards any object it wishes to approach. Its mouth is large, and the jaws are furnished with several rows of blunt teeth. There were two long appendages (apparently claspers) attached to the ventral fins; tail long, tapering, with three rows of rough elevations. The length of the example was between thirteen and fourteen feet.

In the month of September, 1807, a female of this species, which weighed twelve hundred pounds, was caught in a stake-

net (mandrague) at Nice, and for two days afterwards the male did not cease to wander about the place, until he also fell into the same snare. Their usual haunts are supposed to be at a great depth, from which they are only driven by stormy weather.



CHIMÆRA.

The gill openings on each side outwardly single; upper lip divided into two portions; the fore teeth cutting, two only, above and below.

ARCTIC CHIMÆRA.

RABBIT FISH. SEA APE. KING OF THE HERRINGS.

Simia marina,	Gesner; Nomenclator Aquatilium, p. 153, copied by Jonston, pl. 7, fig. 6.
Galeus acanthias Clusii exoticus,	Willoughby; p. 57, tab. b. 9, copied apparently from Clusius, whose figure was from a badly-dried skin.
Chimæra monstrosa,	Linnæus.
Chimère Arctique,	Lacepede and Risso; the Cat of the latter also.

Among the aberrant forms which lie upon the outskirts of the families of Sharks and Skates without bearing a very close resemblance to either, is the Linnæan genus *Chimæra*, which, although consisting of no more than two recognised species, has been separated into two distinct genera; and that one which particularly comes under our notice is among the most remarkable of fishes, whether we consider its shape and habits, or the coldness of the climate in which it finds its safety and delight. The far greater number of the species in the families above named, are inhabitants of the warm or temperate regions of the ocean; but the Chimæra and its kindred species the Callorhynchus, frequent the coldest portions of the globe; but what is still more extraordinary, these closely-allied fishes are known only in regions wide as the poles asunder.

It is the Chimæra, or to call it by its humbler and more

familiar name, the Rabbit Fish, that is chiefly known within the icy waters of our northern circle of the world, and from which it seldom wanders; so that its occurrence in the most distant, in that direction, of the British Islands, is rare and accidental; and consequently its scientific observers have been few. Indeed, within its native seas it is said to come near the surface only in the dark hours of the night, and therefore it can only be by rare good fortune that its living manners shall fall under the inspection of any one. For these reasons we find ourselves compelled to lie under an obligation to two or three of the students of nature for what we have to say of this curious fish, as regards either its form or habits; and of these we shall assign the preference to the French naturalist Lacepede, which we do principally from the consideration that he appears more than others to have observed and studied it in its living condition. We have figures which probably are correct on the whole in the works of Bloch and Donovan; but the colours are perhaps a little exaggerated, for Gesner informs us that the drawing he had received from a friend, and which formed the first announcement of this fish to the world, was simply of a greenish tint. The figure by Lacepede, which I copy, appears to answer more closely to his description than either of the others above mentioned, and it also more emphatically bears out the fanciful similitude of the fabulous Chimæra of the ancient Greeks, from which Linnæus derived its scientific name.

According to the French author above referred to, the activity, in connection with the grotesqueness of the movements of this fish, the flexibility of its very long and slender tail, its manner of uncovering its teeth, and continually twisting about the different portions of its flexible muzzle, forcibly call up in the spectator's mind the grinning and absurd actions of the monkey; while the singular form of its body, its long tail, (much like that of a snake,) joined to a massy head which resembles that of a lion, with the long first rays of its dorsal fin representing in some sort the mane of that beast; to which we add in the male a small elevated horn on the fore part of the head, that is crested with a tuft of slender threads, which may be supposed to represent the crown of the king of beasts. The lineaments of the other parts of the body at

first view appear unnatural, and bear little likeness to anything found in the generality of fishes.

In its body, although not more than three feet long, it has much resemblance to a Shark. It is compressed in a slight degree at the sides, and lengthened, and rapidly diminishes from the pectoral fins to the end of the tail. The skin is pliant, smooth, and covered with scales so small as not to be sensible to the touch, but they are so bright and silvery as to cause the whole surface to shine. In some cases there are brown patches scattered over this surface, by which the brightness is rendered more conspicuous. The large head is of a pyramidal shape, ending in a point at the muzzle, the top of which is about the same height as the eyes, which are large; and near them is the lateral line, which is white, sometimes edged with brown, and on each side reaching to the middle of the tail, where it descends below the lower portion of the body, to be joined with the corresponding line on the other side. Near the head the lateral line divides into several waved branches, one of which passes over the back to meet a branch of the line from the other side. Two other branches pass round the eye and meet at the snout. A fourth proceeds to the corner of the mouth, and a fifth passes in a crooked direction under the last-named along the lower surface of the snout, and becomes mixed with its fellow on the other side. The surface of the body is soft and flexible, folded on the lower portion, and furnished with numerous openings for the supply of mucus.

The pectoral fins are large, falciform, having at their root a fleshy base. The dorsal fin rises by a long, firm, three-cornered spine, which is notched along its hinder edge. This fin becomes suddenly lower and then again wide, to the space opposite the vent. There is a very small space between it and the second dorsal, the rays of which are about the same length as those which end the first, but which become lower gradually to the tail, where they end. In some instances, however, this interval between the fins does not exist, so that some naturalists reckon three fins in the space along the back where others mention only one. The tail ends in a long and very slender filament. The anal fins are two, of which the first is very short and slightly falciform, beginning below the

place where the lateral lines of each side join each other. The second is very narrow and short. The ventral fins enclose the orifice of the vent, and, like the pectorals, are united to a fleshy base. Its mouth is small, and each jaw is supplied with two long plates with cutting edges, having furrows that cause them to resemble distinct incisor teeth. In the palate also are two flat and triangular teeth. Besides the crest which stands in front of the head, near the snout of the male fish, there are before the ventral fins two organs, which are in some degree like small feet, and have nails, but their use is the same as that of the claspers in the Sharks and Skates. It is only at the time of depositing its eggs that this fish comes into shallow water, and it is then seen only at night, for the brightness of sunshine appears to dazzle its eyes. Its ordinary food is crabs and shell-fish, but it also feeds eagerly on herrings, and probably also on other fish.

We add a short description from Dr. Fleming, as referred to at the beginning of this article, of an example sent to him from the Orkney Islands; the more especially as it shews some difference from that of Lacepede:—The length nearly three feet; body compressed. Head blunt; the snout sub-ascending and blunt. A narrow crenulated grinder on each side in the lower jaw, and a broad tubercular one corresponding above. Nostrils immediately above the upper lip, contiguous, each with a cartilaginous complicated valve. Branchial openings in front of the pectorals, (and it appears from some observers that the marks of the five internal channels are visible on the surface, although the outlet of the gills is single on each side.) Eyes large, lateral. The lateral line connected with numerous waved anastomosing grooves on the cheeks and face. On the crown in front of the eyes a thin osseous plate, bent forwards, with a spinous disk at the extremity on the lower side. The first dorsal fin above the pectorals narrow, with a strong spine along the anteal edge. The second dorsal arises immediately behind the first, is narrow, and is continued to the caudal one, where it terminates suddenly. The pectorals are large and sub-triangular; ventrals rounded, in front of each a broad recurved osseous plate, with recurved spines on the ventral edge. Claspers pedunculated, divided into three linear segments; the anteal one simple, the retral ones having

the opposite edges covered with numerous small reflected spines. A small anal fin opposite the extremity of the second dorsal; caudal fin above and below, broadest near the margin, gradually decreasing to a linear produced thread.

It is not the least remarkable portion of the history of this fish, that whilst its most chosen residence is in the depths of the polar seas, it is also found in the Mediterranean, where it has been caught so frequently as to have received the familiar name of Cat from the fishermen of Nice. In explanation of this we can only suppose that in some former distribution of the temperature of our world, this fish inhabited other regions than those in which it is at present found; and that the extreme depths of the Mediterranean Sea continue to afford it all the requisite conveniences for life and propagation, that are now also found, and more generally, in the more northern regions.

ACIPENSER.

The mouth under the snout, without teeth, the jaws capable of being drawn within the cavity. Barbs generally four, about midway between the mouth and snout. Nostrils in front of the eyes; spiracles behind the eyes; a single opening to the gills, covered with a moveable operculum. The tail with unequal lobes, and the vertebræ continued along the upper lobe as in Sharks.

STURGEONS.

With a general likeness to the form of the Sharks, there are in this genus some remarkable departures from it, which shew a greater variation from that type, and a nearer approach to the bony class of fishes, than are seen in any other of the plagiostomes or cartilaginous tribes, in some particulars even amounting to a positive contrast. We may conclude also that the difference is equally great in the internal and less-observed organization, especially of the brain, which is of small size, and the nervous system in general; for their instinctive disposition of timidity and the absence of violent appetites are more distinctly marks of variation, than the particulars to be pointed out of their merely external shape.

The head of the Sturgeons is lengthened into a snout, which is slightly turned up; and the mouth is placed far beneath, with sensitive tendrils about midway between the mouth and snout. There is a spiracle behind each eye, by which a current of water is supplied to the gills, when, as must often happen from the manner in which they seek their food, the necessary supply cannot be obtained through the mouth.

But at this point the resemblance to the family of Sharks becomes interrupted by the feebleness of the jaws, and the entire want of teeth; and in place of a formidable arrangement of offensive arms, as in that order, the lips are soft and fleshy, with, in the case of the Common Sturgeon, separate lobes, that from the nerves distributed to them we judge to be

endued with considerable powers of feeling and taste; in which sensations they are aided by the barbs which hang from the under surface of the snout. The fifth, or infraorbital pair of nerves, which are particularly the organs by which sensation or feeling is distributed, is furnished to the snout and barbs; while the facial branch of the nerve of hearing proceeds to the integuments of the mouth and lips, and also to the gill-covers, thus offering no slight support to the opinion that Sturgeons are susceptible of the influence of sounds, as well as of other acute sensations.

In the nostrils also these fishes differ from the Sharks and Skates, by having them placed above the snout, and in front of the eyes, where it is usual to find them in the fishes characterized by the usual bony skeleton. The form of the body, and especially of the tail, approaches to that of the Sharks; but the resemblance of the latter becomes less on close inspection; for although the lobes are unequal, and the vertebral column is continued along the upper lobe to the end, the fin itself is distinctly supported by branched rays, as in many of the fishes belonging to other tribes. The general texture of the skin bears a near resemblance to what is found in Skates, being soft, and thickly covered with mucous pores; but the bony plates on the sides and head possess a texture and use which differ from what is generally found in plagiostomous fishes, and cause this family to display a closer approach to a class which Mons. Agassiz has denominated the Placoid race; of which a large proportion is only found fossil, but of which one of the distinguishing characters is that they have on their bodies a defence of plates, shields, or scales, which are covered with a thick and firm coat of enamel. These plates are arranged in lines lengthwise on the body, and on the head and cheeks are flattened into shields; closely pressed together, in something like regular order, but without that strict orderly arrangement, at least along the middle line of the head and snout, which has been claimed for them, and by which it has been supposed some separate species might be defined.

Professor Owen supposes that the intention of this special armature on the head and body is chiefly for protection in the situations which these fishes frequent. They were designed, he says, to be the scavengers of the great rivers; they swim

low, grovel along the bottom, feeding in shoals on the decomposing animal and vegetable substances which are hurried down with the debris of the continents drained by those rapid currents. Thus they are ever busied in re-converting the substances, which otherwise would tend to corrupt the ocean, into living organized matter. "These fishes are therefore duly weighted by a ballast of dense, dermal, osseous plates, not scattered at random over their surface, but regularly arranged, as the seaman knows how ballast should be, in orderly series along the middle and at the sides of the body. The protection against the water-logged timber and stones hurled along their feeding-grounds, which the Sturgeons derive from their scale armour, renders needless the ossification of the cartilaginous case of the brain or other parts of the endoskeleton, and the weight of the armour requires that endoskeleton to be kept as light as may be compatible with its elastic property and other functions. The Sturgeons are further adjusted to their place in the liquid element, and endowed with the power of changing their level and rising with their defensive load to the surface by a large expansive air-bladder." Protection to the eye is even more necessary than the other portions of the body, and accordingly this is provided for, in addition to the bony crust that surrounds and overtops it, by being deeply sunk in its small chamber, into which probably it still more deeply falls when danger threatens.

How far the habits of these fishes will support the wide interpretation applied to their rigid armature by the above-named eminent philosopher, I am not prepared to decide; but there is another benefit, consistent with that already mentioned, which is derived from the presence of those plates, and which will be of great use to these fishes in some of the situations in which they must often find themselves placed. The bones of Sturgeons are remarkably soft, even for a race of fishes in which none of the bones are hard and firm; and they do not possess ribs, which organs afford so strong a fulcrum for support to the action of muscles in bony fishes; but their place is well supplied by those substantial plates, which are not simply a covering to the surface, but dip within between the layers of the organs of motion, and thus enable the muscles of the body to exert such a degree of action as otherwise they would not be capable of.

But by the evidence of an intelligent fisherman, reported by Gesner, these plates are also on some occasions converted into weapons of offence; and he had seen them used as such against the Huso, another fish of this family, of a still larger size than the Common Sturgeon but of a very timid nature, and against which the latter species is supposed to bear an instinctive animosity. The skin of the Huso is without any of those plates with which others of this family are defended, and it has been seen therefore to suffer severely from the rough treatment of those cutting and tearing instruments brought into action by its enemy, from which it has sought in vain to escape by plunging in all directions.

Nor is the internal organization of this family of fishes less a departure from the usual type of the Sharks, while still here also remains some degree of likeness, at least in the presence of a spiral valve to the intestine; by which organization the functional power is lengthened out, whilst the bulk of the organ is packed into the smallest space its nature admits of.

These fishes neither deposit their eggs in purses nor produce their young alive; but their roe consists of small grains, which they shed in the same manner as bony fishes, in the fresh-water of the larger rivers; which they enter for that purpose, and in particular districts, especially of the south of Russia and the Caspian Sea, in enormous multitudes, in consequence of which extensive and flourishing fisheries are established for taking them. Their productiveness may be judged from the fact that, according to Pallas, ("Second Travels," vol. i,) of the three species fished for seventeen hundred and fifty thousand have been caught in one year. Fifteen thousand have been taken in a day by one method of fishing; and, what is still more remarkable, if the fishermen should have been accidentally prevented from working during a single day, the fish have been known to accumulate in such numbers at the weir, as to fill the whole channel; insomuch that those which were uppermost appeared with their backs above water, in a river not less than twenty-eight English feet deep, and sixty fathoms wide.

With such numbers it may be concluded that Sturgeons of the different sorts are highly prolific; and Adolph Erman, in

his journey into Siberia, mentions an example, of only six feet long, the roe of which measured two quarts; and another is recorded, that weighed two hundred and seventy-three pounds, the roe of which amounted to forty-two pounds, the supposed number being almost two millions. It is not therefore in purses, or by internal hatching, that the young are produced to life, but more strictly in the manner of bony fishes, the grains being, however, rather large, and separated from each other throughout the mass by layers of fat. It is one of the principal objects of the Russian fisheries to obtain this roe, which is carefully prepared, and valued by epicures under the name of Caviare.

Another valuable product of this fishery, and of more general importance, is isinglass; which is formed of the air-bladders of two or three species of this genus, and of which, one of the smaller kinds, *(A. ruthenus,)* is said to produce the best. The organ from which it is prepared is not found in any other of the plagiostomous genera, Sharks or Skates; but in the family of Sturgeons it appears to be of great use in enabling the fish to rise and fall frequently and rapidly amid the currents of the larger rivers, as well as in the deeper waters of the sea. The structure of this organ has a remarkable peculiarity, in the existence of a duct or passage of no small size, which passes from the bag to the gullet, and by which the air within may be occasionally discharged, and perhaps again renewed from without; for we are not able to affirm positively what is the special or complicated object of a structure which is only shared by a few of the fishes furnished with an air-bladder. In an example of the Common Sturgeon, of about eight feet in length, which I knew caught in a trammel in the open sea, as the fish was raised from the ground some observable bubbles of air were seen to break from the water; and I have no doubt they had been discharged from the fish, perhaps under the influence of the terror produced by its capture.

Isinglass was known in ancient times by the name of ichthyocolla, or fish-glue, and it was used in the medical practice of Greece and Rome as a principal ingredient of their adhesive plaisters; but the fishes which produced it were on another account a subject of attention to the Romans of the flourishing times of the empire.

At a time when luxury had reached perhaps the greatest development it has ever attained, the Sturgeon is named as one of its principal objects; but it has been thought strange that while the Common Sturgeon is often taken on the shores of Italy, the poet Ovid, as if unacquainted with it in Italy, should term it

"The noble Sturgeon *from a distant sea.*"

Varro also informs us, (de Re rustica, B. 2,) that the best of these fishes were caught near the Island of Rhodes, on which account, we are told, they were sometimes called the Rhodian Galei, or Dog-fishes; to which Clumella adds, (B. 8, C. 16,) that this favourite fish was not found anywhere else. On these accounts Cuvier drew the easy conclusion that our Common Sturgeon was not the species so highly valued by the noble epicures of Rome, but another species of the same family, the Sterlet, *(A. ruthenus,)* which is still held in high reputation in some countries.

But in Cuvier's remark above referred to, as compared with Ovid's verses, there is an obvious oversight which requires explanation. Not only does the Roman poet speak of the *Acipenser* in the terms we have given, but in another portion of the same poem he shews that he distinguishes between the Rhodian fish and the true *Acipenser*, and that, too, by only a slight variation of the same words:—

"Tuque peregrinis Acipenser nobilis undis...
Et preciosus Helops nostris incognitus undis."

"The noble Sturgeon from a distant sea...
Unknown the precious Helops in our sea."

A Dutch commentator has endeavoured to reconcile the apparent contradiction between the words applied to the *Acipenser*, and the fact of its not unfrequent occurrence in Italy, by supposing the poet to mean that this fish, as obtained in distant countries, was of better quality than such as were procured in his native land.

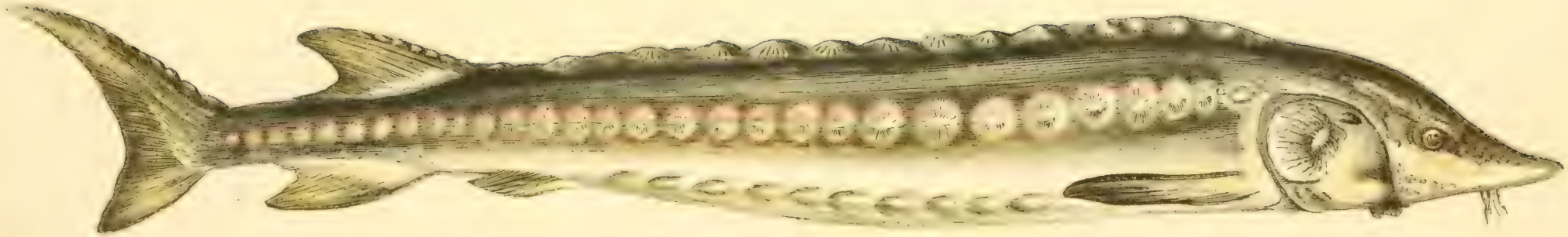
But that this most highly-valued of the family of Sturgeons, (the Helops,) was the same with the fish known to the Greeks by the same name, (Elops, or Ellops,) we learn as well from Pliny, as from circumstances attending its capture as described by Ælian, from which we find no difficulty in tracing the

origin of ceremonies concerning it as they were practised at Rome; and in so doing, also confirm our knowledge of the species.

The Greek author informs us that when fishermen were so fortunate as to have caught an Elops, they adorned themselves and their boats with garlands, and brought the fish to land with shouts and music. The difference between this and the ceremony practised at Rome was only that the procession was made to marshal its progress from the kitchen to the table, instead of from the boat to the shore; and it was perhaps on account of the ceremony and the attendant expense, that Martial in one of his epigrams, pronounced it a fish properly fit for a table at the palace; as by a sort of traditionary remembrance, built on a mistake, but countenanced by law, the only Sturgeon known among us is still spoken of as subject to royal authority.

But in spite of its former reputation, in the time of Pliny the Elops had sunk greatly in estimation; at which circumstance he expresses his wonder, as it possessed the principal qualification for exciting interest in the opinion of his countrymen,—of being brought from a very remote distance.

But although it thus appears beyond doubt that the Common Sturgeon was not the fish so highly valued at the time referred to, we learn further from Ælian some facts, from which we may safely gather that this more common species was in that day, as it had long been, the object of extensive fisheries in the rivers of the Caspian Sea. The name he gives it is Oxyrhyncus, or the Sharp-nose; and he says that it grows to the length of eight cubits, that it was salted and dried, and sometimes by taking away the fat it was made into meal,—a process which may apply to the preparation of what is now termed Caviare; and in this condition it was carried on camels to Ecbatana, in Persia. They also made glue of a superior kind by boiling the entrails; and this, from its strength and transparency, was employed in the formation of elegant works of ivory.



COMMON STURGEON.

Sturio,	Jonston; pl. 23, figs. 8, 9, 10.
" *acipenser, silurus, the Sturgeon,*	Willoughby; p. 929, tab. p. 7. The name of *Silurus* had been applied to this fish by previous authors, who from ignorance had confounded it with the Sheat-fish, *Silurus glanis,*
Acipenser sturio,	Linnæus and Cuvier. Bloch, pl. 88.
" "	Donovan, pl. 65. Fleming; Br An., p. 173.
" "	Gray; Cat. Br. Museum, p. 13.
" "	Jenyns; Manual, p. 493.
" "	Yarrell; Br. Fishes, vol. ii, p. 475 and 479; Second Supplement.
Acipensere Esturgeon,	Lacepede and Risso.

The Common Sturgeon is the only one of this family which wanders widely from the principal haunts of its race. It is even found in the colder parts of the northern ocean, and not a season passes in which several are not taken on the coasts of Europe and the British Islands; where they often exercise their instinctive quality of pushing their way through the course of the deeper rivers. It is the opinion of naturalists that, as in the case of the Salmon, this reciprocal change from salt-water to fresh is important to the health of the fish; and that it is not adopted for the purpose alone of depositing spawn appears from the fact that no instance has been detected of the shedding of roe in British rivers, where, from their multitudes, they could scarcely have escaped discovery. A few examples have occurred where a fish has been obtained among us of small size; and an example in the possession of Mr. Yarrell measured only a foot in length. But I believe no record exists of the place whence this specimen was obtained, and it is not certain that the roe when shed is injured by being placed in salt-water.

The Sturgeon is sometimes taken of a size which must strike with wonder those who have only had an opportunity of seeing the usual inhabitants of our rivers, among which, this fish appears indeed a Triton among the Minnows. From eight to ten or eleven feet is the usual length, and the weight is to the full correspondent with the dimensions. In some rivers especially, as the Parret, and on the Welsh Channel near Swansea, large Sturgeons have shewn themselves at particular periods, as well as in the Wye and Usk; and it is to be noticed that this has happened about the month of May, at which time they are ceasing to be caught in the Caspian and Russian rivers, the only time of ceasing to fish for them in the last-named countries being in summer. The largest example recorded as British is mentioned by Pennant, and weighed four hundred and sixty pounds. I possess a memorandum of another, which weighed three hundred and fifty pounds; but what are these in comparison to the enormous *Acipenser huso*, which has been seen of fifty-six feet in length.—(Historical and Geographical Description of the North and East Part of Europe and Asia, by J. P. Strathlenberg, 4to, 1738.) He speaks from personal knowledge.

Although the Sturgeon is a timid fish as compared with the generality of the inhabitants of the sea, its great strength may render it capable of inflicting considerable injury on those who meddle with it incautiously, on its becoming entangled in their net. A blow from the tail would probably break the leg of a man. As a precaution therefore, the fishermen accustomed to the work endeavour to bring the fish sidewise to the land, with the net enclosing it, and the head lifted out of the water, in which position it ceases to offer any further resistance. A Sturgeon which was caught within my knowledge, was entirely helpless after it had discharged an observable quantity of air, although it then lay in a net at the depth of several fathoms.

When at liberty it is the habit of this fish to seek its food by turning up the soft bottom of the river or sea with its sensitive and moveable snout; and the quickness of feeling in these parts, including the barbs hanging from them, enable it to discern and select whatever is appropriate to its appetite. Worms are probably a favourite food, but in a paragraph

taken from an American newspaper, I have seen it announced that a lady's riding-whip, twenty-one inches long and mounted with silver, had been found in the stomach of a Sturgeon of no large size. The fish might be of a different species from our own, but the fact seems to shew that not all of them are satisfied with merely molluscous food.

The Common Sturgeon is generally valued at the tables of the rich; and indeed it appears that by some mistake the high reputation of the once celebrated Sterlet or Elops, has slid away to what, by all accounts, although still good, is a fish of lower quality. When taken in the Thames, within the jurisdiction of the Lord Mayor, it is usually judged a proper present for the Royal table; but although still regarded as a dainty, it is mentioned among other things by Fitz-Stephen, who wrote an account of London in the twelfth century, as being a dish to be obtained with ease at the then newly-erected hostelry in the city.

Dr. Parnell, when closely studying the British fishes of the northern districts of our island, was led to believe that there were two British species of what had hitherto been treated as one; and from the prominent characters on which his distinction was built, he was led to give them the names of the Broad-nosed and the Narrow-nosed species. If individual examples are to be selected there is no doubt that such a division might be maintained; and accordingly, naturalists, whose observations at this early stage were limited to the few examples preserved in museums, came forward to confirm these distinctions, and to add others derived from the particular nature and arrangement of the bony plates covering the head. The more modern works on the natural history of fishes, contain illustrative figures of this kind; but more extended inquiry has gone far to throw doubt on the supposition that there is more than one British species of the Common Sturgeon. The Broad-headed and the Narrow-snouted varieties in their extreme divergency differ greatly, and the latter appears to be the most numerous of the two. But there has been found every gradation of form among them, so that in many an instance it would be difficult to assign its proper place to the individual example; and with regard to the form and arrangement of the plates which cover the head, although

in the more prominent parts there is some approach to regularity, on the whole this may be even the least depended on. Not only do the different varieties differ in this respect, but the variation exists in the same individual; so that a cord, laid along the middle line from the top of the head to the snout, shall sometimes separate the sides into portions which do not answer to each other.

With regard to the plates on the back, Linnæus, in his specific character of this fish assigns to it a row of eleven plates along the dorsal ridge; whereas Willoughby tells us that he had counted from eleven to thirteen in several different examples; and particularly he mentions that behind the single dorsal fin there were no dorsal plates, where in most figures they are represented; and in the specimen presently to be described this portion of the body was ornamented and defended by a pair of parallel rows. Several other variations of figure might be brought forward, but I judge sufficient has been said to shew that the division of this well-known Common Sturgeon into two species has a less certain foundation in nature than has been supposed.

Our description of this fish is taken from an example kindly presented by William Thompson, Esq., of Weymouth, whose desire to extend the boundaries of science has shewn itself in similar instances on many former occasions. In this instance the obligation is so much the greater that it has enabled me with more ease, and at longer intervals, to examine the minuter particulars of form and structure, than if I had been limited to an inspection of what was exhibited in the boat of a fisherman, or a fishmonger's shop.

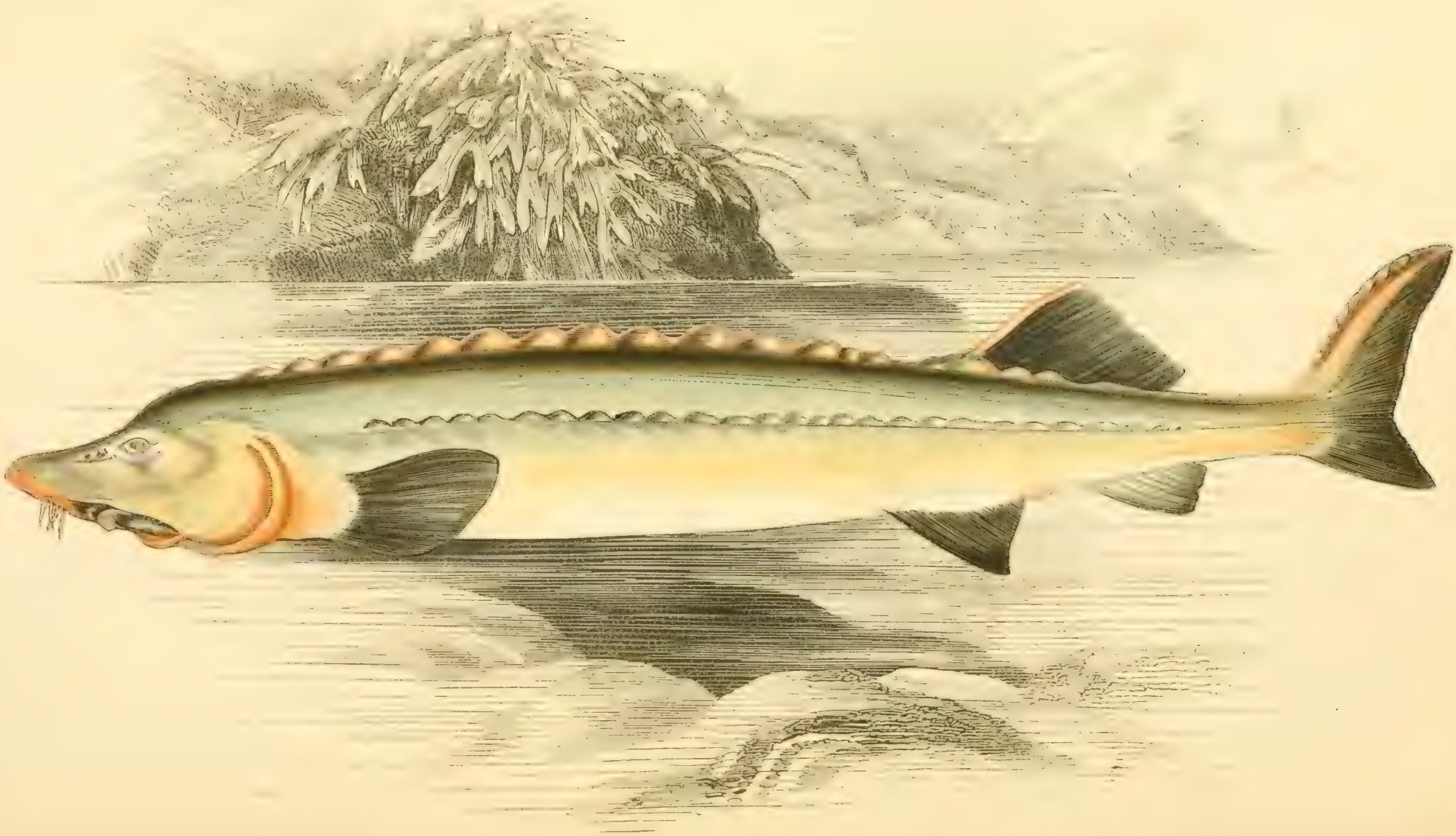
The example described measured three feet seven inches in length. The head at top is depressed into a wide channel, with the ridges on the sides more prominent; it slopes gradually to the snout, which becomes almost sharp at the end, where it is slightly bent up. This surface, and also the sides of the face, are formed of a bony crust which is divided into sections; but when first from the water these divisions can scarcely be made out, and it is only when the surface has become dry that those plates can be distinguished, which have been represented in drawings of those parts. An elevated prominence stands before each eye. The plates are more numerous, smaller,

and more separate over the snout; and in all cases, as well of the head as body, their surface is rough with radiated lines. The eye is small, and sunk into a well-guarded cavity, but is probably capable of protrusion. The nostrils are large, in front of the eyes, and have a single cavity within, of which the bottom is formed of a full circle of separate bony rays, proceeding from a centre. On the surface it is crossed by a membranous band, which gives the nostril the appearance of being double, as in most bony fishes, but I could not discern any membranous division within. The mouth is fleshy, retractile, and seems not capable, except by living action, of being closed. Teeth none. Bones of the jaws slight, the lips with lobes, which probably have a quick feeling of touch and taste. In front of the mouth, and rather nearer the snout than it, are two pairs of tendrils, of considerable length. A small spiracle behind the eye, between the border of the anterior gill-cover and the plates of the head. The hinder gill-cover, which is much the largest, being formed of a single plate, with radiating lines, appears fallen in and incapable of concealing the gills, the more especially as these gill-covers do not possess a membranous border.

The body is lengthened. The dorsal and lateral ridges, which are five in number, are so prominent that the surface appears flaccid between them, the surface being soft and flexible, with numerous pores. The dorsal row of plates, of which the summits are not incurved, consist of fourteen, there being an interruption in the line, where the place of one is represented by a pair. The first rays of the dorsal fin are also armed with plates along their edge; between that fin and the tail there is a double parallel row, the edge of the caudal fin being also guarded by pointed plates. Number of plates on the side thirty, on the border of the belly ten, reaching to the ventral fins. Pectoral fins wide, with the first ray stout, seeming to admit of motion easily forward and backward, but not freely above or below. The ventral fins are far behind, but anterior to the vent; the dorsal and anal hook-shaped, and not far from the tail. The upper lobe of the caudal fin is lengthened, and the vertebræ, as in the Sharks, carried along to near its edge, but there is no slit to separate the upper lobe from that below. The rays of this fin differ from those

of Sharks in general, in being bifurcated or divided after the manner of bony fishes. The colour a dull olive blue, the belly white.

In common with a multitude of other things, the Sturgeon has been an object of superstition. That quaint but learned hunter out of such recondite matters, the antiquarian Aubrey, records it as commonly reported, that before an heir of the Clifton of Clifton, in Nottinghamshire, dies, a Sturgeon is caught in the River Trent near that place.



HUSO.

XXXVI

HUSO.

Huso,	Willoughby; p. 243, tab. p. 7.
Acipenser huso,	Linnæus. Cuvier. Bloch, pl. 129.

We introduce the name of this species into our pages, because we would direct the attention of British naturalists to the possibility of its occurrence in our waters, and in the hope that on the report of the capture of an example of what might pass as the common species, an examination may be made, whether in fact it may not be an example of this, as yet questionable species. It stands on the list of Irish fishes, as having more than once been met with in that country; and so much as is known of these reported captures, is given in the fourth volume of Mr. William Thompson's "Natural History of Ireland;" but unfortunately no figure or particular description appear to have been taken from the fishes themselves. The following is all that Mr. Thompson says on the subject;—

"In 1847 I contributed the following note to the 'Annals of Natural History,' vol. xx:—'Isinglass Sturgeon, (*Acipenser huso,* Linnæus.) A notice of the occurrence of this species on the coast of Cork, in July, 1845, was communicated to the 'Annals,' (vol. xvi, p. 213,) by Mr. John Humphreys, of the city of that name. This gentleman, as well as Dr. Harvey, of Cork, who subsequently examined the specimen, assures me that it was *A. huso,* as represented in Shaw's 'Zoology,' vol. v, pl. 159. Mr. Humphreys has informed me of the capture of another specimen, which was taken in the second week of April, 1847, at Carrigeen, near Curriglass, on the River Bride, not far from its junction with the Blackwater. It measured seven feet eight inches in length, and weighed nearly two hundredweight."

Shaw's description of this species is as follows:—"Isinglass

Sturgeon, (*Acipenser huso*, Linnæus.) A larger fish than the Common Sturgeon, having been often found of the length of twenty-five feet; general shape the same; colour dusky, or blackish blue above, silvery on the sides and abdomen, with a tinge of rose-colour on the latter; general appearance smoother than in the Common Sturgeon, the dorsal tubercles being less protuberant, and those along the sides much smaller, and in some specimens of a very advanced growth altogether wanting; mouth much larger than in the *A. sturio*, with thick crescent-shaped lips; skin smooth and viscid. Native of the Northern, (Black,) and Caspian and Mediterranean Seas, migrating from them into the adjoining rivers; found more particularly in the Volga and Danube."—(Shaw's "General Zoology," vol. v, p. 375, pl. 159.)

Another description is,—Snout very obtuse, shorter than the diameter of the mouth, but like the Common Sturgeon, subject to variation in this respect. Eyes very small. Body thick, with five rows of plates; the fins small. As the fish attains its full growth these plates often drop off, so that none appear.

I find among my notes, that, in company with Mr. Yarrell, I had an opportunity of seeing the head and tail, without the body, of a Sturgeon, the snout of which was very short, flat and bent upward, as that of the Huso is represented in the very rough plates of the older writers; but as Mr. Yarrell has not referred to this species in his work on British fishes, I conclude that he did not suppose the evidence of its being the Huso sufficient to authorize his classing that species among the acknowledged fishes of our seas.

BONY FISHES.

The large family of bony fishes, or Acanthopterygians, is readily distinguished from the Plagiostomes, and from a third that will follow, by marks which are easily recognised; and which also are closely associated with the instincts and modes of life of the several subordinate tribes of which this class is composed. The visible prevailing characters are, that the jaws are nearly equal, and at the extremity of the head. Every departure from this particular will appear only relative. In their mode of formation as well as generally in shape, their teeth differ from those of the Sharks, in having their origin in a membrane which lies along the border of the jaws, and they rise directly from this portion of their gum, with their points upward, into the place where they are to remain, supplying the place of such as have already performed their duty, and, by losing their attachment, are about to be shed. There is, therefore, a perpetual succession, but it is of individuals and not of ranks. They are attached to, but do not penetrate into the jaws; and the formative membrane does not perish, as in Sharks, with the teeth it had formed. The nostrils are usually double, and of small size, placed above the line of the snout, and before the eyes. The gill openings are single on each side, with often a wide aperture, and usually also with a gill membrane, furnished with bones. The body is, for the most part, covered with scales; the fins usually stand on joints, often with firm spines, and the membrane is usually to be easily distinguished from the rays, even when the structure is less firm. The tail partakes of the nature of the other fins; the vertebra ending in a separate plate, perhaps divided into branches at its root; and to it the caudal rays are attached.

The races are continued by the shedding of spawn, the grains of which are of small size. In a very few species, one or two only of which are found in Britain, this spawn is hatched within the body of the parent; and in one other remarkable family, (the *Syngnathi*,) some very curious means are adopted to secure the completion of this natural proceeding. But whatever subordinate variations of these general principles, of form or habit, may offer themselves to our notice in particular families, will be pointed out in their proper place.

GASTEROSTEUS.

The cheeks covered with mailed plates. Back with free spines anterior to the dorsal fin. These spines have usually a slight membranous border on their posterior edge, but do not constitute a fin. The belly is strengthened with a stout bone in front, from whence the generic name. To this bone, and the apparatus attached to it, are fastened the ventral fins, the outer ray of which is a weapon of offence. The gill membrane has no more than three rays.

Linnæus reckons this genus in his class of thoracic fishes; in which the ventral fins are not attached to the thorax, nor behind to the pelvis, but to the belly between these parts, and nearly under the pectoral fins.

THREE-SPINED STICKLEBACK.

BANSTICKLE. MINNIS. SHARPLING. PRICKLEFISH.

Pungitius Alberti,	Jonston; with a very poor figure.
" "	Willoughby; p. 341, tab. x, 14, the figure bad. He supposes this fish to be the *Centriscus* of Theophrastus.
Gasterosteus aculeatus,	Linnæus and Bloch; pl. 53.
" "	Donovan; pl. 11.
" *trachurus,*	Cuvier. Rough-tailed Stickleback.
" *gymnurus-semiarmatus,*	Cuvier. Half-armed Stickleback.
" *leiurus,*	Cuvier. Smooth-tailed Stickleback.
" "	Yarrell; Br. F., vol. i, p. 90, 94, 95.
" *brachycentrus,*	Yarrell; Br. F., vol. i, p. 96,? and in Loudon's Mag., vol. iii, p. 521.
" *spinulosus,*	Yarrell; Br. F., vol. i, p. 97?
" "	Jenyns; Manual, p. 348.
" "	Dr. Gunther; Catalogue of Fishes in the British Museum, vol. i, p. 2.
Gastérostée epinoche,	Lacepede and Risso.

This race of fishes is generally of small size, and on that account commonly overlooked or disregarded by the casual observer. Yet they occupy an important place in the economy

of Providence, whilst the elegance and complexity of their form, only require examination to excite admiration, and their habits and instincts are so full of curiosity as to secure attention when it has been directed towards them.

Our Common Sticklebacks are inhabitants of both salt-water and fresh, but they do not in preference frequent the open sea, and a quiet union of the sea-water with the fresh appears the most congenial with their nature,—as we may judge by the abundance to be met with in such situations. In large ponds of this description they increase to an enormous extent, and may be seen traversing their daily range again and again, in numerous companies, and hunting eagerly for food, which appears to be formed of any of the smaller inhabitants of the water they are able to swallow. Myriads of the half-developed young of flying insects—the smaller creatures whose office it is to keep down superfluous increase of vegetable life, but which themselves might otherwise multiply in numbers too great, so as to be among the evils themselves were destined to abate,—and, we must add, the young of such fishes as are then bursting into life: all of these contribute to the sustenance of these tribes of wandering plunderers, until at last their numbers also have grown to be excessive. Birds feed on them; but their formidable enemy is man, and with his net they are swept to the bank in helpless heaps, to become of some service to the people who have been at the trouble to catch them. In some places they are employed for the purpose of feeding ducks or pigs; and sometimes they are drawn on shore in such heaps as to serve for manure, for which purpose they are said to be of considerable value, a fact not improbable, when, according to Lacepede, they are known to afford by pressure a good supply of oil, which we suppose can only come from the liver.

In the Baltic, Professor Nilsson says that about the beginning of November, before they retire to their winter quarters, they assemble on the coasts of that sea in incredible shoals, and are caught in boat-loads by fishermen. The only use made of them is to boil them for the purpose of skimming the fluid for the oil. A bushel of these fish yields about two gallons of oil. The refuse is employed for manure.

They breed generally in summer, and then it is that the most

amiable and intense of their feelings are stirred into exercise, and a degree of ingenuity brought into action, which the world has agreed to deny the existence of among the inhabitants of the waters, but which observation has shewn to prevail especially in this small family, although perhaps it only requires more extended observation to prove its existence in other families also.

The earliest notices that were given to the world on the care bestowed on their young by the family of Sticklebacks, were derived from a careful watching of the proceedings of another species, the Fifteen-spined Stickleback, (altogether an inhabitant of the sea,) to which reference will be made again. But the observations which follow were recorded independent of such as apply to the last-named fish; and, taken in connection with them, they claim perhaps an additional degree of interest from the fact that they were made by an observer of nature who was unacquainted with natural history as a science, and especially could not have been aware of what was then closely studied by others on a kindred species. The following is extracted from a periodical publication of the year 1834, entitled the "Youth's Instructor."

"In a large dock for shipping on the River Thames, thousands of Pricklefish were bred some years ago, and I have often amused myself for hours by observing them. While multitudes have been enjoying themselves near the shore in the warm sunshine, others have been busily engaged making their nests, if a nest it may be called. It consisted of the very minutest pieces of straw or sticks, the exact colour of the ground at the bottom of the water, on which it was laid, so that it was next to an impossibility for anyone to discover the nest, unless they saw the fish at work, or observed the eggs. The nest is somewhat larger than a shilling, and has a top or cover, with a hole in the centre, about the size of a very small nut, in which are deposited the eggs or spawn. This opening is frequently concealed by drawing small fragments over it, but this is not always the case. Many times have I taken up the nest, and thrown the eggs to the multitude around, which they instantly devoured with the greatest voracity. These eggs are about the size of poppy seeds, and of a bright yellow colour; but I have at times seen them almost black, which, I

suppose, is an indication that they are approaching to life. In making the nest I observed that the fish used an unusual degree of force when conveying the material to its destination. When the fish was about an inch from the nest, it suddenly darted at the spot, and left the tiny fragment in its place, after which it would be engaged for half a minute in adjusting it. The nest, when taken up, did not separate, but hung together like a piece of wool." The place chosen by these fishes for their nest is where the ground forms an inclined plane, and in about six inches of water.

Individuals of these fishes were placed in a glass vessel, that their proceedings in forming the nest and bringing forward the young might be the more conveniently observed. A nest was accordingly formed, but unfortunately the female died soon after the process of shedding the roe had been perfected. The male was seen to be often engaged in throwing a current of water through the nest, and in an early part of the proceeding he often rubbed his body over it, which was supposed to be for the purpose of shedding the milt. The eggs, in number about fifty, were brought to life in three weeks, and at first the young appeared transparent. The male, which, in other instances also, seemed to have the sole care and protection of the brood, attended upon them carefully; and if any one of them trespassed beyond the allotted bounds, he followed and brought the truant back in his mouth, and again replaced it in or near the nest.

The Swedish naturalist Eckstrom gives, as the result of his observation, a different account from this; and it will be worthy of inquiry whether the proceeding may be different in different countries. As soon, says he, as the nest is ready, the male dresses himself in his finest colours, which are blue, green, yellow, and silver; and swimming among the shoals of females which are assembled in the neighbourhood ready to deposit their roe, he lures one of them into the little arbour; and when she has spawned he proceeds to entice another, until at last he has accumulated a large number of eggs; over which he keeps a strict guard until they are hatched, which is in about three weeks; and even after this his care does not cease, for he is seen even to collect food and bring it within their reach.

It is thus that protection of the young is the important

trust committed to the male fish, until by growth they are able to take their place among the full-grown tribes of their race. And well ought they to be fitted for this position, for it not unfrequently involves danger on every side. There are circumstances, indeed, which render it probable that at times, perhaps periodically, an epidemic fury seizes them, and that a general slaughter of the weakest is the result. Mr. Peach, to whom I have already had occasion to refer, informs me, that in the north of Scotland, where this fish is common, they get into pools of the rocks at the highest water-mark of the tide, and build their nests. Unconnected with the sea, except at spring tides, the water becomes warm from the heat of the sun; and there the young are hatched under the guardianship of the parents, until they are strong enough to quit the place; after which, toward the decline of the year, not one is to be found, except, indeed, some scores of the adult fish, which are left dead, without any other obvious cause besides their mutual love of fighting.

But little attention indeed is sufficient to discover that this little family of fishes is an irritable race, and disposed to a display of the domineering impulses of tyranny and oppression, in the exercise of which they are not slow to manifest their consciousness of the formidable nature of the arms they bear, and of their power to wield them with deadly effect. Woe betide an enemy that ventures on an attack. I placed an individual of the best-armed variety in a vessel in which two small crabs were already confined, and being not a little hungry, one of the crabs shewed an inclination to make the new-made prisoner his prey. But in all his attacks the Stickleback was equal to the occasion. He kept his well-armed tail towards the enemy, and depressed and employed it in a manner unlike what most fishes could accomplish, but in which the inferior processes of the vertebræ were shewn to be no hindrance.

The following will further illustrate these manners of the Sticklebacks, as they are brought into active opposition with each other, and where the contest is with no other apparent object than a display of the pride of victory. "Having," says a writer in Loudon's "Magazine of Natural History," vol. iii, "at various times kept this little fish during the spring and

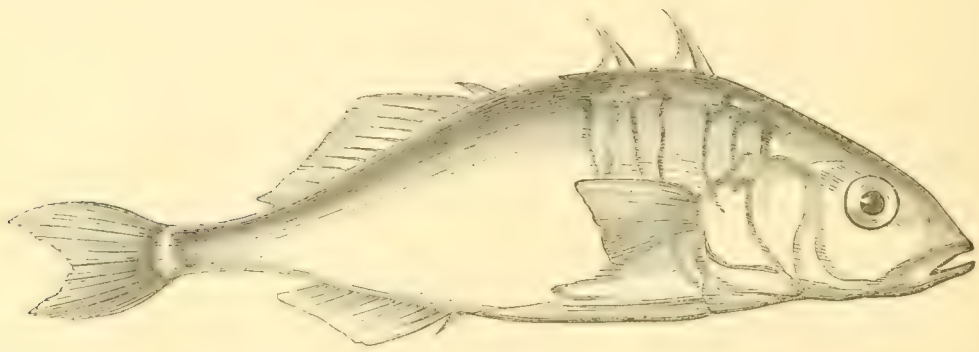
part of the summer months, and paid close attention to their habits, I am enabled, from my own experience, to vouch for the facts I am about to relate. I have generally kept them in a deal tub, about three feet long, two feet wide, and about two feet deep. When they are put in, for some time (probably a day or two) they swim about in a shoal, apparently exploring their new habitation. Suddenly one will take possession of the tub, or, as it will sometimes happen, the bottom, and will instantly commence an attack upon his companions; and, if any one of them ventures to oppose his sway, a regular and most furious battle ensues; they swim round and round with the greatest rapidity, biting, (their mouths being well furnished with teeth,) and endeavouring to pierce each other with their lateral spines, which, on these occasions, are projected. I have witnessed a battle of this sort, which lasted several minutes before either would give way; and when one does submit, imagination can hardly conceive the vindictive fury of the conqueror, who, in the most persevering and unrelentive way, chases his rival from one point of the tub to another, until fairly exhausted with fatigue. From this period an interesting change takes place in the conqueror, who, from being a speckled and greenish-looking fish, assumes the most beautiful colours; the belly and lower jaws becoming a deep crimson, and the back sometimes a cream-colour, but generally a fine green, and the whole appearance full of animation and spirit. I have occasionally known three or four parts of the tub taken possession of by as many other little tyrants, who guard their territories with the strictest vigilance, and any, the slightest invasion brings on invariably a battle. As may be expected they usually fight best on their own ground, and the invader is generally repelled; but when the contrary occurs the victor adds the defeated party's possession to his own. A strange alteration takes place almost immediately in the defeated party; his gallant bearing forsakes him; his gay colours fade away; he becomes again speckled and ugly; and he hides his disgrace among his peaceable companions, who occupy together that part of the tub which their tyrants have not possession of; he is, moreover, for some time the constant object of his conqueror's persecution. It is scarcely necessary to observe that these are the habits of the male fish alone; the females

are quite pacific, appear fat, as if full of spawn, never assume the brilliant colours of the male, by whom, as far as I have observed, they are unmolested. The bite of these little furies is so severe, that I have frequently known it, when inflicted on the tail, produce mortification, and, consequently, death. They also use their lateral spines with such fatal effect, that, incredible as it may appear, I have seen one during a battle absolutely rip his opponent quite open, so that he sunk to the bottom and died. Another fact in the history of these interesting little creatures also deserves notice: it is curious, and to me unaccountable. Previously to death they re-assume all their brilliant colours, which they may have lost from defeat; but they are not so clear and distinct as when in the height of their power."

It was one of the results of Baron Cuvier's more attentive examination of the differences among the species hitherto considered identical, that he was led to separate what had before been regarded as one species of Gasterosteus into three, on the foundation of the different degrees of arming of the plates which cover the sides. On the authority of such a competent observer this division of species at first met with little opposition, and accordingly it found a place in Mr. Yarrell's "History of British Fishes," where each of these supposed species is individually represented. From this first, however, Mr. Jenyns expressed his doubts, which he stated in his work referred to at the beginning of this article. Renewed enquiry has gone on to shew further, that if these three varieties are to be definitely distinguished from each other, several others must fall under the same distinction; since there is no exact number of increase or decrease to the plates on the sides, on which characters it was the definitions were built. And these are not the only parts which are liable to variation, although the others have not been taken into account by writers whose attention has been directed chiefly to systematic arrangement. But if for the sake of simplicity, as well as of truth, we can consider the British species of this family that are marked by three or four free dorsal spines, as only varieties of one, we may with confidence affirm that no known kinds of fishes are equally disposed to vary their forms or change their apparent character. I shall best

satisfy the intention I have in view in the account of these fishes, by giving a description, as well as a figure, of each of the varieties as they have come within my observation; and my earnest thanks are due to Edmund T. Higgins, Esq., of Bristol, for the opportunity I have had of examining some examples of more than the usual size—giants of their race—which were obtained by him from the neighbourhood of Liverpool, and selected from a multitude of others that shewed no difference from the more common examples obtained in other districts.

Willoughby describes this fish as growing to the length of two inches and a quarter, and Mr. Jenyns to three inches. My largest example measured three inches and three fourths; its depth one inch. The body compressed, sloping circularly



from the first spine to the mouth; under jaw longest, gape rather small, teeth conspicuous. From the upper jaw the head is covered with a cuirass, the border of which bends down at the sides on a line with the gill-covers; a separate plate with a blunt projection about the pectoral fins. The pectoral fins attached to a broad half-circular plate, and below this a plate which extends a rounded angle back towards the belly. On the ridge of the back are three plates, on the two hindmost of which are seated the two first free spines; a third and shorter spine is close to the origin of the dorsal fin. Four plates pass downward from these dorsal plates or shields, and two of them reach the ventral plates, one of which is broad, and covers the belly to the vent. It is bound down through the whole length, and a prominence or line runs

through the middle of it; and on each side of the origin of this flat plate or ventral shield (which in some degree serves the purpose of a sternum, as well as a defensive armour for the breast,) is a sharp spine of considerable length, and finely serrated on its upper border or edge. This formidable spear is in fact one of the two which serve to spread the membrane of the ventral fins, but it is the weapon with which all the deadly contests of this fish are conducted. There is a slight spine in front of the anal fin. The dorsal and anal fins are on the hinder part of the body; and the origin of the latter is a little behind that of the former. The body grows slender as it approaches the tail, the latter organ in its folded state being concave. When dry the plates or shields before mentioned appear rough. Colour of the back olive brown, well defined on the sides; below, and on the fins and tail a dull yellow: the colours influenced, no doubt, by the spirit in which these fishes had been preserved. Formulæ of the fin rays,—pectoral ten, dorsal fifteen or sixteen, ventral two, caudal eleven, with some small rays.

Another example of the same variety, and about the same

length, was of a much more slender form, and in other respects, different proportions, the dorsal and anal fins being also carried nearer to the tail; and in a third, which may be termed the Half-armed Stickleback, while the depth of body nearly answers to the example we first described, the dorsal and anal fins are reduced to much smaller dimensions, there is an elevated ridge near the side of the tail, and the tail itself is straight. The lateral plates in this variety never descend to join with the shield of the belly, and contract suddenly in dimension opposite the third dorsal spine. The colour of these fishes partakes of every variety, from sober brown to a brilliant green, with reddish or crimson tints.

TINKER.

TEN-SPINED STICKLEBACK.

Piscis aculeatus minor,	Willoughby; p. 342.
Gasterosteus pungitius,	Linnæus. Bloch; pl. 53, f. 4.
" "	Donovan; pl. 32. Lacepede.
" "	Fleming; Br. Animals, p. 219.
" "	Loudon's Mag. of Nat. Hist., vol. iii, p. 332.
" "	Yarrell; Br. Fishes, vol. i, p. 99.
" "	Jenyns; Manual, p. 350; Zoologist, vol. xiv, p. 5124.
" "	Gunther; Catalogue of Fishes in the British Museum, vol. i, p. 6.

There is a little fish of the family of Sticklebacks, which is still smaller than the ordinary size of the three-spined species, so that it is almost the smallest of British fishes; but, although widely dispersed, it is not so commonly met with as the others. In shape it is a little more slender, and the body is not defended with plates, although a slight ridge near the tail is represented in Donovan's plate, and referred to as of casual occurrence by Cuvier and other describers; but it is particularly distinguished by having nine or ten spines (Willoughby says eleven) on the back; these spines being of course smaller and closer together (Fleming says more irregularly disposed) than in the three and four-spined species. As distinguished from the others its habits are best described by Mr. Newman, in the "Zoologist," as above referred to, whose account we therefore for the most part copy. Another observer also remarks, that although less formidably or securely armed than most of the others, it is much the most quarrelsome of its family.

Mr. Newman says:—"In the 'Fishes of Scandinavia,' plate iv, fig. 2, is figured, under the name of *G. pungitius*, a

Gasterosteus having nine spines on the back, and coloured red about the lower jaw, cheeks, gill-cover, and base of the pectoral. I have to regret that my ignorance of the Swedish language prevents my understanding a single word of the description, but the plates in this work are the most scrupulously accurate of any natural history representations I have yet seen, and therefore I take the evidence as perfectly conclusive, that the *G. pungitius*, or 'Sma Spigg' of Sweden, is a fish the male of which assumes a red breast in the breeding season. There is no doubt that the *G. pungitius* of Linnæus, Cuvier, and of the 'Fishes of Scandinavia,' is one and the same fish. Well then, we arrive at this conclusion, that there is on the continent of Europe a fresh-water Gasterosteus, which has constantly nine dorsal spines, (but Nilsson assigns it ten,) which has keeled scales on the sides of its tail, and the male of which, in its nuptial livery, is red about the gills and breast, like the familiar *G. aculeatus*.

"Now for the contrast: we have in the ditches round London myriads of a very minute fresh-water fish, known to every boy who goes a *stilling* by the name of Tinker; this fish has nine spines on the back, a perfectly smooth tail, and the male in nuptial livery is of the most intense velvety black, never by any chance exhibiting the slightest tinge of red. Turning again to Cuvier I find appended to the description of *G. pungitius* the following note, (translated:)—There is also in our streams a species nearly akin, (*G. lævis*, Cuvier,) which is without this arming: and in the subsequently published "Natural History of Fishes," by Cuvier and Valenciennes, (v. iv,) this smooth-tailed species stands as *G. pungitius*, the *G. pungitius* of the animal kingdom being omitted altogether.

"Mr. Yarrell has given two figures of a *G. pungitius* in the first and second editions of his admirable history; neither of the cuts gives an exact idea of our familiar little Tinker, but that in the first edition comes the nearest. The description in both editions is the same, and is comprised in a very few words. The colour is described as a yellowish or olive green on the back; sides and belly silvery white, with minute specks of black; fins pale yellowish white."

Mr. Newman then goes on to describe the fish as found near London. The separate spines are nine in number, and

each of them has a small triangular fin membrane at its posterior base; all of them are erectile at the pleasure of the fish, and when erected it is seen that they are not seated exactly on the median line of the back, but on two lines, each removed, almost imperceptively, to the right and left of a median line; on one line there are five spines, on the other four, and they are seated alternately. Every spine, moreover, on the right line has a most decided inclination to the right, and every spine on the left line to the left, so that the series are well represented by the teeth of a saw recently set, when they are alternately and purposely bent to the right and left. The carinated scales on the sides of the tail, which Cuvier makes a character of *G. pungitius*, are entirely wanting. The colour is very uniform, as compared with that of our ordinary Sticklebacks; it is a somewhat metallic yellow green on the back, gradually becoming paler, and almost white on the belly, the whole being *irrorated* with minute black dots; the fins are very pale, almost colourless. The male resembles the female until the month of March, when he begins to assume his nuptial livery: the median line of the breast and belly then becomes black, a colour which day by day extends on either side until all the lower parts of the fish become of the most intense velvety black; this eventually extends almost over the whole body, the back only retaining slight indications of the normal colouring.

It is a fearless and ferocious little fish, instantly reconciled to captivity, and attacking with fury any prior inhabitant of the vessel in which it is placed. It will frequently seize a fellow-prisoner by the gill, the tail, or a fin, and retain its grip with the firmness of a bull-dog; in the same way it will instantly seize a worm when presented to it, and allow itself to be drawn out of the water without relinquishing its hold. The females become very much distended with ova, and deposit them simultaneously; they are very large, generally eight or ten in number, and are immediately devoured if found by fishes of the same or other species: its nest is not known to me. Unlike other species of Gasterosteus it will not exist when confined in salt-water, however diluted. Mr. Newman's doubts of the identity of this species, arising from the difference of colour, would have ceased if he had recollected how

strongly many fishes, and this family in particular, are disposed to assume their tints from the nature of the ground in which they live, a fact well known to fishermen, and Ovid, in ancient times, when he says of another inhabitant of the waters, (the Polypus)—

> "Sub lege loce mutatque colorem;"
> "The place's law compels to change its tints."

Nor is the presence of a ridge or scales near the tail a surer mark of the distinction of species, for among the three-spined species, this ridge, naked or plated, is found to occur indiscriminately.

With regard to the number of dorsal spines, above referred to, Nilsson says that they are *about* ten in number; that this fish is about an inch and a half or two inches in length, which shews it larger than with us; and that it is common in all the waters of Scandinavia. The three-spined species, he says, is even found within the arctic circle.

FIFTEEN-SPINED STICKLEBACK.

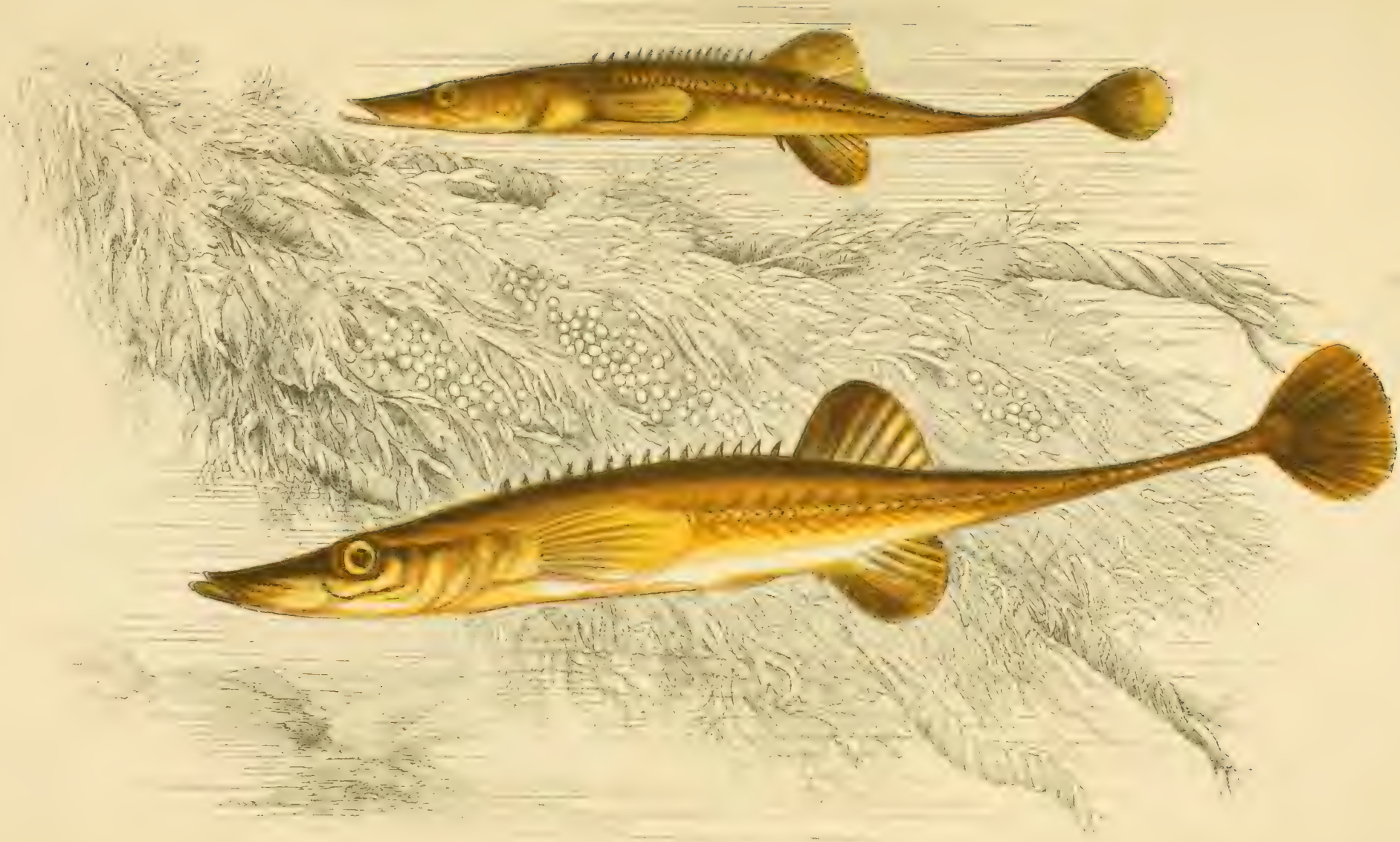
SEA ADDER;

Confounding it with the Pipefishes or Syngnathi, to which it bears some resemblance in shape, and especially in the form of its snout and the angles of its body. Bismore in Scotland.

Aculeatus marinus major,	Jonston; Tab. 47, but I find no description.
" " "	Willoughby; p. 340, and Appendix, p. 23, Tab. x, 13. It is remarkable that Willoughby had never seen this common fish, and his figure at last was taken from a dry specimen in the Museum of the Royal Society.
Gasterosteus spinachia,	Linnæus. Bloch; pl. 53, f. 1.
" "	Donovan's Plates, p. 45. Lacepede.
" "	Jenyns; Manual, p. 351.
" "	Yarrell; Br. Fishes, vol. i, p. 101.
Spinachia vulgaris,	Fleming; Br. Animals, p. 219.
" "	Gunther; Cat. of Br. Museum, vol. i, p. 7.

This fish never enters fresh-water, but it is well known on all the coasts of the United Kingdom, from the extreme north of Scotland to the Land's End, in Cornwall; and within a few years it has drawn to itself special notice from its having been discovered to be in the habit of forming a nest for the security of its young, and for watching over their safety in it with much care, to the time when they become excluded, and capable of taking care of themselves among the other inhabitants of the waves; a discovery which solicited the more attention, that it was made, or at least published, before a similar proceeding had come to light in the habits of one or two more of the species of the same natural family that we have already spoken of.

The first obscure notices of this remarkable and hitherto



FIFTEEN-SPINED STICKLEBACK

unsuspected proceeding appear to have been entertained in Scotland; but the subject was prosecuted with greater care and success in Cornwall, by Mr. Richard Q. Couch, who, however, underwent the fate of many other discoverers, in having the fruit of his researches stolen from him into a foreign language without acknowledgment; to be translated back into English by one who was ignorant of the fact that he was doing no more than bringing into his own country what in truth had before been filched away from it.

The places selected for these nests are usually in harbours or some recess near the open sea, where, with the presence of the pure water of the ocean, there is shelter from the open violence of the waves. Sometimes they hang in pools of the rocks, but it is not rare to find them between tidemarks, where they are left uncovered by the tide for two or three hours. The moisture of the materials appears sufficient to save the grains of spawn from suffering injury by this exposure.

The method of proceeding in forming these nests appears to be that the fish either find growing, or, certainly in some instances, collect together some of the softer kinds of green or red sea-weeds, and join them with so much of the coralline tufts (Janiæ) growing on the rock as will serve the purpose of affording firmness to the structure, and constitute a mass five or six inches long, of a pear-like shape, and about as stout as a man's fist. A thread is employed with much skill and patience in binding these materials together; and there is no doubt that its substance is obtained from the creature's own body. It much resembles silk, and is elastic. Under a good magnifier it appears to be formed of several smaller threads glued together, and it hardens into firmness by exposure to the water. But there is reason to believe that it is not exuded, nor the roe deposited, all at once; for as it is passed through the mass with intricacy in various directions, the roe appears in little clumps, which are in different degrees of development.

The grains are of large size in proportion to the magnitude of the fish, and of a bright amber colour. They are watched over by the parent—in every case, I believe, by the male—who never long quits his station; but an instance has occurred where two fishes have been engaged in attending one nest;

and if the guardian is forced to retreat by the receding of the tide, he returns as soon as the way is open, and for three or four weeks he continues his guard, until the young are able of themselves to take their chance in the broad expanse of sea. So much is he intent on the principal object of his solicitude, that at this time himself may be easily caught; but he resents every interference with the nest; and if the grains of ova be exposed to sight, as was done by way of trial, the breach was immediately repaired by the labour of dragging the materials into a position by which they are again concealed and protected.

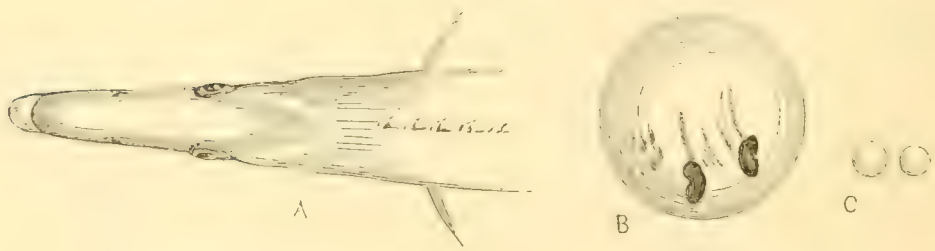
A singular instance of constructive skill and patience in the formation of its nest, which occurred within my knowledge, is deserving of remembrance. The situation selected was the loose end of a rope, from which the separated strands hung at about a yard from the surface, over a depth of four or five fathoms; and to which the materials could only have been brought, of course in the mouth of the fish, from the distance of about thirty feet. They were formed of the usual aggregation of the finer sorts of green and red ore-weed; but they were so matted together in the hollow formed by the untwisted strands of the rope, that the mass constituted an oblong ball of nearly the size of the fist; in which had been deposited the scattered assemblages of spawn, and which was bound into shape with the thread of animal substance already described, and which was passed through and through in various directions, while the rope itself formed an outside covering to the whole. We can scarcely suppose that such a nest can have been the work of more than a couple of fishes, but the grains of spawn had grown to almost the size of radish seeds, and in collective bulk seemed greatly disproportionate to the size of the parent, and only to be explained by the well-known fact, that the ova of fishes generally obtain an increase of bulk by the absorption of water after exclusion; which fluid may be supposed to exert considerable influence on the further development of the young. The embryo of this fish, as is believed to be the case with many others, is not found to bear a close resemblance to the parent, and, in fact, may be said to pass through a decided metamorphosis in the course of its final development.

A nest selected for observation had its outer case formed of green sea-weeds, within which were short pieces of brown weeds; and, contrary to the usual custom, it was watched by a couple of these fishes. At the precise time of quitting the egg, the young were placed under a magnifier of moderate power, when it was observed, that instead of a long protruded snout, the form of the head was round and blunt, the pectoral fins were large, and a dorsal fin passed along the greater part of the back to be united to the caudal fin, from which again it advanced to form an anal fin. In some examples this union was by an uninterrupted border, but in others there was a notch at the place where the dorsal and anal fins came together. The belly was protuberant, and in some the ovum was still visibly attached to the body; and as the part of union was diaphanous, globules could be seen, that had passed from the egg to the intestine. No ventral fins could be perceived, which is less a matter of surprise that it has been observed in other instances—these organs are the last that go through the process of development. The truly apodal fishes (such as are always without ventral fins, as the Conger,) are, in fact, in a condition of arrested development in this particular. How widely different is this form from that of the parent! and yet, when half an inch in length, the lineaments are perfect. These little newly-born fishes were active and voracious, for they eagerly attacked such of their fellows as fell dead to the bottom of the vessel in which they were confined.

This species is capable of great activity, and when in captivity I have known it to throw itself over the brim of a vessel where the water was three inches below it. It feeds on crustaceous animals, and indeed on any animal substance it is able to swallow; and I have known it to attack and partially devour an eel of three inches in length, which, however, it was compelled finally to reject.

The usual length is about six inches; the head compressed at the sides, wide and flat on the top, lengthened before the eyes, which are moderately large and brilliant. Under jaw the longest; both have teeth; the lips fleshy; tongue far back in the gullet. Nostrils mid way between the snout and eyes, and appearing to exert a sensitive action when the fish is at

liberty. The gill-covers with large plates; the membrane with three rays. The body lengthened, growing slender as it approaches the tail, and depressed. The lateral line raised into a ridge of sharp overlapping plates, forty in number, but probably liable to variation. The belly bordered with a prominent bony rim; vent at the middle of the body. Dorsal and anal fins rounded, at the beginning of the posterior half of the body, and opposite each other. Between the head and the dorsal fin is a row of fifteen spines, each of them edged on the hinder part with a slight membrane. Pectoral fins rather large, reaching backward to the tenth dorsal spine. Ventrals opposite the extremity of the pectorals, placed apart, with three rays, the first strong and hooked. A strong spine before the anal fin. The tail wide and round. The colour liable to vary; in some reddish brown on the back, first rays of the dorsal fins, and tail; in others deep green; and in some instances (as, indeed, in many other fishes) quickly changing under the influence of terror. The cheeks and sides are often golden yellow, lighter on the belly. Fin rays—pectoral nine, ventral three, dorsal seven, anal eight, caudal twelve.



A.—Head of Fifteen-spined Stickleback. B.—Egg of ditto magnified.
C.—Eggs natural size.

PERCH.

PERCA.

The body compressed, rather deep, covered with firmly-fixed scales. First gill-cover with a serrated edge, on the second a spine. Jaws and roof of the mouth with numerous fine and slender teeth. Two separate dorsal fins, the first with spinous rays. These fishes, and several of the following genera, separated for convenience from the original genus *Perca* as constituted by Linnæus, are what that author named thoracic fishes, because their ventral fins are placed below the pectorals.

PERCH.

Perca major,	Jonston; Titul, 3, C. 1.
Pearch,	Izaac Walton's Angler.
"	Willoughby; p. 291, Tab. S. 13.
Perca fluviatilis,	Linnæus and Cuvier. Bloch; pl. 52.
" "	Gunther's Cat. of Br. Museum, vol. i, p. 58.
" "	Fleming; British Animals, p. 212.
" "	Jenyns; Manual, p. 330.
" "	Yarrell; British Fishes, vol. i, p. 1.
La Perséque Perche,	Lacepede.

The Perch is one of our best-known river fish, and is generally distributed over the kingdom; but it is with some exceptions, for it is not found in Scotland north of the Forth, except where it has been introduced, and it is not a native of Cornwall, although it has been conveyed thither within the present (nineteenth) century, and in the few places where it is known it thrives well. This fish, indeed, is capable of living out of water for a considerable time under favourable circumstances, and has been known to have been carried without injury a distance of forty miles, enclosed in wetted moss. It is said to be a custom in some parts of Germany, to carry this fish alive to market, and if not sold, to return it to its native element for another opportunity, as was

formerly the case in England with the Pike and other fishes.

The Perch prefers lakes and the deeper and less rapid pools of rivers, where they herd together in companies in the winter; and it is probably for want of such accommodation that it is not naturally an inhabitant of the extreme north or west of Britain. But when the warmth of spring begins to be felt it becomes more active, and passes into the more rapid parts of the stream; where the angler employs his baits with great success, for this fish feeds eagerly on almost every animal it is able to swallow. Worms, the larvæ of insects, young fishes newly struggling into life, and even the smaller newts and frogs, are indiscriminately devoured, and form therefore successful baits for taking this fish. It will spring out of the water to catch some sorts of flies; but in grappling with the more formidable Sticklebacks, it sometimes suffers the injury, which, under like circumstances, itself inflicts upon the Pike. The formidable spines of the back and ventral fins are driven into the membrane of the mouth, and cause such fretting ulcerations as to lead to its destruction. It has been said that from dread of these firm and piercing dorsal spines the Pike, however voracious, will shrink from attacking the Perch; but that it is not always thus cautious is shewn by an accident recorded in the following verses, where it had seized a very large Perch, after the latter had taken the angler's hook. The writer, comparing this Perch to a smaller one, says—

> Oh, had you seen, in Ely's merry isle
> His bulky brother which a Cyclops strook
> With hempen cable and rough hammer'd hook;
> Long tugg'd the brawny blacksmith at his game,
> At last encumber'd with huge load it came,
> Half buried in a Pike's enormous maw,
> Its finny spears fast wedged into his jaw.
> Scarce eight full pounds—
>
> Angler, 1758.

A further character of these roving companies is referred to in the succeeding verses:—

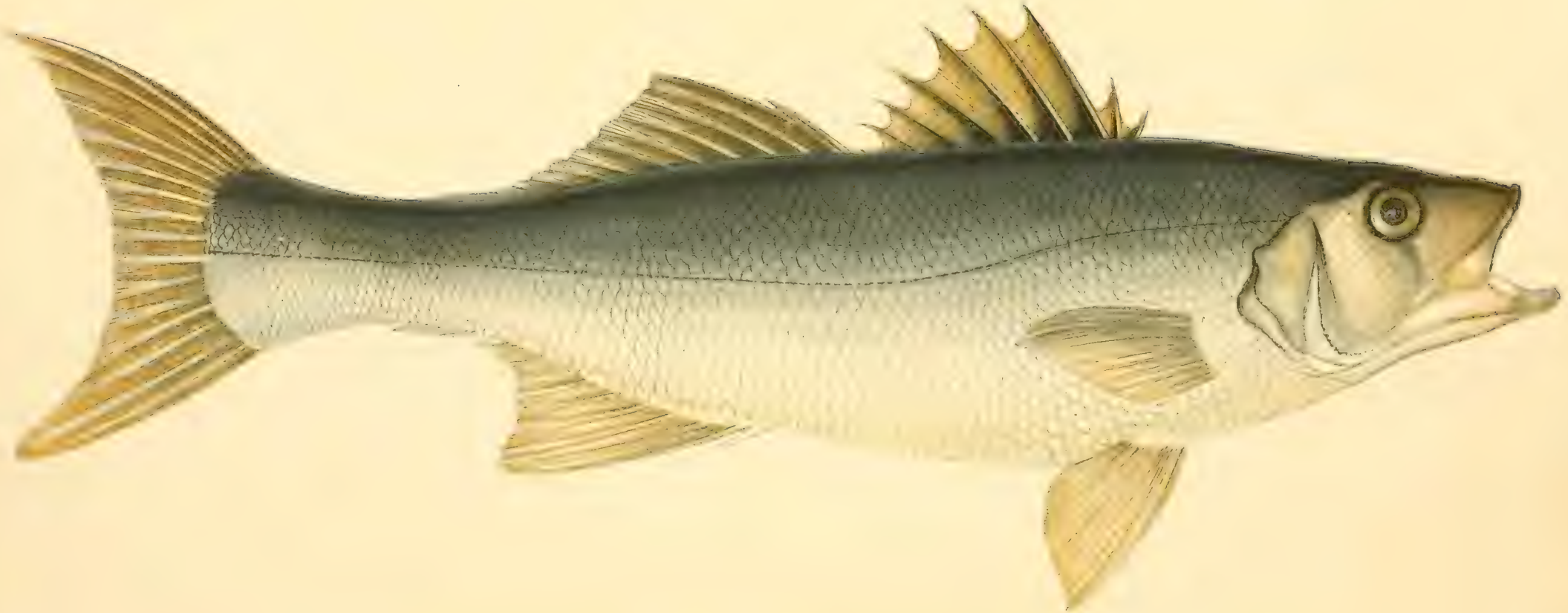
> Perch, like the Tartar clans, in troops remove,
> And urged by famine or by pleasure rove.
> But if one prisoner, as in war, you seize,
> You 'll prosper, master of the camp with ease;
> For, like the wicked, unalarmed they view
> Their fellows perish, and their path pursue.

According to Professor Owen, the milt and roe are single in the different sexes. According to several authors it does not breed until the third year of its age, and in spawning it seeks for some pointed piece of wood, against which it presses the vent; and when some of the spawn has become attached to this substance, it moves in different directions, so as to draw out the ova, which are enveloped in a cord of tough mucus, much like that of the common toad. The quantity of spawn is often large, and has been known to weigh one fourth part of the whole weight of the fish; but the bulk becomes much increased after it is shed, by the absorption of water into its substance.

It is much valued for the table, and the skin has been employed in the place of glue, in the manner described by Linnæus, "Lachesis Lapponica:"—"The glue used by the Laplanders for joining the two portions of different woods of which their bows are made, is prepared from the Common Perch in the following manner:—Some of the largest of this fish being flayed, the skins are first dried, and afterwards soaked in a small quantity of cold water, so that the scales can be rubbed off. Four or five of these skins being wrapped up together in a bladder, or in a piece of birch bark, so that no water can get at them, are set on the fire in a pot of water to boil, a stone being laid over the pot to keep in the heat. The skins thus prepared make a very strong glue, insomuch that the articles joined with it will never separate again. A bandage is tied round the bow while making, to hold the two parts more firmly together."

The usual size of a full-grown Perch is from nine or ten inches to a foot in length; but examples are on record which have much exceeded these dimensions. Willoughby says that he had seen one which measured fifteen inches; and Izaac Walton mentions an instance which came to his knowledge, where it measured nearly two feet; and Hawkins, in his Notes to the "Complete Angler," refers to one twenty-nine inches in length. The form of the body is compressed and deep; and the outline rises in an arched direction from the mouth to a little in advance of the first dorsal fin. The mouth is terminal, and the jaws about equal; teeth slender and numerous in the jaws, and over the palate. The body and part of the cheeks covered with

small but firmly-attached scales. Eyes large; nostrils, as in all this family of fishes, double, and between the eyes and point of the upper jaw. The first gill-cover (preoperculum) finely serrated; the hindmost furnished with a flattened spine. Lateral line passing along nearer the back. The first dorsal fin rounded and well developed, with firm and prickly rays, of which the fourth and fifth are commonly the longest; the second dorsal near the first, and opposite the anal; the latter with two firm rays at its commencement. Tail concave. The colours are lively, but subject to variation. The back a rich brown, sometimes greenish; cheeks and sides yellow, the belly white. A variable number of broad bands of the colour of the back pass round the sides. The first dorsal fin flesh-coloured at the base, bluish near the margin; the first and last borders dark, almost black. Pectoral fins pale; the ventrals, second dorsal, anal, and tail red. Fin rays—first dorsal fourteen, second dorsal fourteen, pectoral twelve, ventral one to five, anal two to five, caudal eighteen.



BASS.

XL

BASS.

Lupus,	Jonston; c. 2, t. 23, f. 3.
"	Willoughby; p. 271, tab. r. 1.
Perca labrax,	Linnæus.
Bass,	Donovan; pl. 43. Risso; p. 213.
"	Fleming; Br. Animals, p. 213.
Labrax lupus,	Cuvier, who separates this fish into a new genus, because its tongue is rough, which that organ in the genus *Perca* is not.
" "	Jenyns; Manual, p. 331.
" "	Yarrell; Br. Fishes, v. 1, p. 8.
" "	Günther; Catalogue of Fishes in the Br. Museum, vol. i, p. 63.

The Bass was known to the Romans by the name of Lupus, or the Wolf; a designation which has been supposed expressive of its great voracity. But it appears to me that the word describes the manner in which it deals with its prey, rather than merely the eagerness with which it pursues it. Let the weather be stormy and the water turbid, and the Bass of largest size will hunt along the shore, and even in very shallow water, for whatever it can find, but especially for onisci and other crustaceous animals, which under such circumstances are often thrown from their hiding-places in crevices of the rocks. Fishermen who employ hand lines from the shore, are aware of this, and choose this time, at the flood tide rather than the ebb, for their most successful fishery. If they are able from the clearness of the water to discern the bottom, they do not expect this fish to take the hook. At other seasons the Bass will assume a station near some sheltering rock, and there keep watch for any passing prey. Suddenly it rushes on its victim, and again returns with it to its former shelter to devour it; remaining still near the same haunt until the appetite is satisfied, or its expectation has failed.

In the opinion of several ancient authors this fish displays

but little sagacity in the way in which it gets itself into situations of danger, but much of that quality in extricating itself from the snares in which it is entangled. To this purport Pliny and Ælian express in prose what Ovid and Oppian give in verse:—that when encompassed with a net, it scoops out with its tail a furrow in the sand, and there lies hid while the net passes over it.

> In like extremity the greedy toils,
> With arts more exquisite the Bass beguiles;
> Low he descends when powerful fear commands,
> And scoops with labouring fins the furrow'd sands;
> Lodged in that cave expected fate derides,
> While o'er his back the leaded foot-rope slides.

Fishermen observe that they often deliver themselves from the line by cutting away the hook; and they suppose it to be done by means of the serrated cutting edge of the gill-cover. But it is more probable that it is effected by drawing the line across the teeth; which are numerous, and capable of acting like a file or rasp. Oppian, in borrowing perhaps from Ovid, gives also another and less likely explanation of their way of escape:—

> "The crafty Bass, whene'er they conscious feel
> Deep in their jaws infix'd the barbed steel,
> Writhing with restive fury backward bound,
> The hook dismissing through the widen'd wound."

The food of the Bass is the smaller fishes, shrimps and other crustaceous animals, and sea-weeds; and they readily take an offered bait. They are most frequently caught in summer and autumn, when many circumstances combine to bring them within reach of the fisherman; but they are rarely seen in winter. It has been said that they breed twice in the year; but it is doubtful whether with us winter is one of these seasons. The young are seen in harbours and at the mouths of the larger rivers in considerable numbers; but when full-grown they become solitary, and prowl along the coast; for they do not commonly seek the deep water; and although capable of living in fresh-water, do not pass into it in preference. They are widely distributed, but are by much the most abundant in the southern counties of England and Ireland. They have been found in the Firth of Forth, but I believe no further

north in Scotland. Belon says he found it in the Red Sea. (Observations, etc., L. 2, c. 67.)

The Bass is in esteem for the table with us; but it was regarded much more highly, and as among the principal of their dainties, by the luxurious Romans of the Empire; who chose to set the highest value on such as were caught in a recognised district of the Tiber, and which those who prided themselves on their exquisite taste professed to be easily able to recognise. Pliny only says that they were the best which were caught in rivers; but from Horace we learn that they must be of small size, and taken precisely between the two bridges of the city, neither above nor far below. (Satires, b. 2, s. 2, where it is to be observed that the translators into English have chosen to render the word Lupus by the English word Pike, to which fish the Lupus does not answer in any particular.) The favoured fish was known by its pale colour, and especially by its white and woolly flesh; and a story is handed down to us by Columella, of the affected horror expressed by one of these fashionable sensualists at a table, where it happened that a Bass not of the right sort was set before him. Having taken a portion into his mouth, he threw it back in apparent disgust, and exclaimed, "I thought it was FISH you had set before me." But their ancestors could not have been so fastidious; for Columella, (de re rustica, b. 8, c. 16,) tells us, that from ancient times these fish had been kept in fresh-water ponds, where they bred freely.

Yet it was the fish preferred by the epicure that ought to have excited disgust; for the favourite station was indebted for its excellency to the great cloaca, or principal drain of the city; and as Willoughby observes, it was owing to their being fed with matters that were discharged from it, that they had obtained the colour and taste which elevated them into reputation. A similar observation has been made in modern times.

Willoughby, and other writers who had seen this fish chiefly in Italy, describe the young as marked with dark spots, which disappear in advanced growth; and Gesner's figure shews it similarly spotted; but no such marks appear in them in our own country. The adult fish reach a considerable bulk; but one of fifteen pounds is considered large. Yet I have been informed of several that weighed twenty pounds, and one has

been named to me that reached twenty-nine pounds. I myself measured an example that was in length two feet nine inches, but its weight was not in proportion to its length. The head and body are compressed, and the latter not so deep as in the generality of this family of Perch-like fishes; but muscular and strong; covered firmly with scales, as is also the first gill-cover. Jaws and palate furnished with numerous small teeth; the tongue as if cut short at its extremity. Anterior gill-cover serrated, but on the lower border this sometimes becomes obscure. The hindmost gill-cover having two blunt spines, and another at the origin of the lateral line. Eyes of moderate size. Lateral line slightly descending, and then straight. Dorsal fins two, in a depression on the back; the first with strong spinous rays, of which the first, and sometimes also the second, are short. Anal fin slightly behind the second dorsal. Tail concave. Colour a bluish grey on the back, lighter on the sides, white below. First dorsal nine, second dorsal thirteen, pectoral sixteen, ventral six, anal fourteen, caudal seventeen, the first ray spinous.

ASPRO.

In dividing the extensive family of Linnæan Perches, Cuvier forms the genus *Aspro*, which, with a somewhat elongated body, has the two dorsal fins separate, the ventrals broad, the teeth very small and thickly set, head depressed. The teeth are on the palatine bones, but not on the tongue.

RUFF.

POPE. JACK RUFF.

Perca fluviatilis minor, and Schrollus,	Jonston.
" *cernua,*	Linnæus. Bloch; pl. 53.
" "	Donovan; pl. 39.
" "	Jenyns; Manual, p. 334.
Cernua fluviatilis, Aspredo, Ruffa,	Willoughby; p. 331, tab. x. 14.
" *fluviatilis,*	Fleming; Br. Animals, p. 212.
Acerina vulgaris,	Cuvier. Gunther; Catalogue Br. Museum, vol. i, p. 72.
" "	Yarrell; British Fishes, vol. i, p. 17.

This little fish is less widely distributed than the Perch, but it is common in the rivers of the midland counties of England, although not found in Cornwall and Devon, in Scotland, or the Isle of Wight. It is not mentioned by Mr. Thompson among the fishes of Ireland; but by Linnæus and other continental writers it is said to inhabit the lakes of (at least the northern parts of) Europe. According to Professor Nilsson it is frequently met with in the middle and northern waters of Scandinavia, but is rare in the south. It is lively in its motions, and chiefly frequents those portions of the river that are rocky or strewed with stones and sand. In other respects it has much the same habits as the Perch, and is angled for

with the same baits. The usual time of spawning is the spring, at which time the roe is shed in large quantity at a good depth in the water, on sandy ground. By some this fish is esteemed for the table.

It rarely exceeds three or four inches in length. The outline of its shape rises from the snout to the beginning of the dorsal fin, and the body becomes more slender as it approaches the tail, which organ is large and forked. The eyes are large, and placed high in the cheeks; front of the head round and blunt; under jaw a little the shortest; teeth numerous and fine. Cheeks with pits; border of the anterior gill-cover with spines, and a longer spine on the hinder gill-cover. The body covered with scales, which are rough to the touch from the nature of the edge of each of them; hence the name of the fish. Lateral line nearer the back. Dorsal fin waved, but undivided, the fourth ray the longest, the breadth growing narrower at the end of the spinous portion, and again expanding as it approaches its termination. Anal fin rather small, ending opposite the termination of the dorsal. Pectoral round; ventrals large, thoracic. The colours vary according to the nature of the river, from a greenish tint on the back to a rich yellowish brown, lighter or whitish below, and varied with scattered spots; fins spotted or with bars of brown; tints of yellow on the sides.

SERRANUS.

This genus has a single dorsal fin, although two classes of rays support its two divisions. Rays of the gill membrane seven in number. First gill-cover serrated, the hindmost with one or more points or spines. Covering of the jaws smooth.

COMBER.

SMOOTH SERRANUS.

Serranus Cabrilla,	Cuvier.
" "	Yarrell; Br. Fishes, vol. i, p. 11.
" "	Gunther; Cat. Br. Museum, vol. i, p. 106.
Channè,	Jonston; Articulus 8.
Channa,	Willoughby, p. 327.
Perca Cabrilla,	Linnæus. Jenyns; Manual, p. 332.
Holocentre serran,	Risso.
Perca channus,	Loudon's Mag. Nat. Hist., vol. v, p. 20.

This is a common fish in the west of the kingdom, and probably also along the south coast of Ireland; but it was long overlooked by naturalists, and supposed to be confined to the Mediterranean, where it appears to have been confounded, under the name of Sea Perch, with another species which it much resembles both in appearance and habits,—the *Serranus scriba,* a species that has not been found in Britain.

The Comber usually keeps in rocky ground at a small distance from land, and is well known to fishermen, who often find it in their wicker crab-pots, which it enters for the sake of the baits that are hung up to entice the crabs and lobsters; but the result is that they become the bait they sought to devour. They are seldom brought to the market, and when caught on the line are usually converted into bait for other

fish; for, although wholesome, and even delicate for the table, their inferior size causes them to be little valued. Their usual food appears to be the smaller crustacean animals and small fishes; but I have found Ophiuræ (Slender Snake Star-fishes) and encrusting corallines (Lepraliæ) in their stomach.

A supposition of ancient date was, that the males and females of this species were united in one, or were hermaphrodites; but although the structure of the ovaries offers some peculiarities, there is reason to believe that the sexes are distinct as in other fishes. Professor Owen was not able to discover anything but the grains of spawn in these organs, as they were sent to him for examination with a microscope; and I have no doubt of having myself distinctly seen the existence of a separate milt. There is, however, some peculiarity in these organs, for at that portion of the ovary where it enters the duct that conveys the spawn or milt, there is a small bag-like sac, and at the outlet of the passage from whence the roe is discharged, an organ, which, under ordinary circumstances, has its orifice turned inward; but on pressing the body the direction of the part is reversed, and the outlet is rendered capable of conveying the discharge to the distance of half an inch. When the pressure is removed this organ resumes a twisted shape, and returns to its situation within the body. Late in the spring and in the summer I have found the spawn running freely from one ovary, and nearly as much advanced in the other, thus shewing that the process is not ended within a very small duration.

This fish also obtained notice in ancient times, from the fact that its death was always attended with a spasm which caused its fins to stand erect and its mouth to be widely open. I have never met with more than a single instance in which the contrary to this was the case, and from this peculiarity it was that among the Greeks it obtained the name of Chanèe and Channos, or the Gaper. Some writers indeed are persuaded that this habit of gaping is natural to it at all times, and that it is produced by the structure of the jaws; but there is no doubt that this latter supposition is built on a mistake, and that when alive the mouth is closed as in other fishes.

In reference to this fish and the *S. scriba,* it may create

some amusement to the reader, if there be introduced to him a little sprinkling of what was known as science in the middle ages, as handed down by one of the then shining lights of the world. Speaking of the medical virtues of some creatures, Albertus Magnus says of the Foca, which is the Fuka, Phykis, or Phykos, (not Phokos or Phokèe,) of Gesner,—the Sea Perch,—that it is a well-known fish, called by the Chaldeans Daulubur, and by the Greeks Labor. Take its tongue and a small portion of its heart, and infuse them in water, and the mixture thus made will cause a multitude of fishes to gather together. Place the same under your arm, and if you have a trial at law it will make the judge your friend.

The largest size of this fish is about ten inches long; the body compressed, deep. Gill-covers and body covered with ciliated scales, which adhere firmly. Under jaw longest; teeth in both, and in the palate, numerous, irregular, sharp, and incurved; the tongue small and loose. Eyes high in the head. First plate of the gill-covers with the border serrated, the second with two (in the female one) obscure spines, scarcely to be distinguished, except in shape, from the scales. Gill membrane with seven rays, curved, the uppermost broad. The dorsal fin begins opposite the ventrals, the first portion having spinous rays, the second, which passes to near the tail, expanded, with soft rays; anal fin opposite the second portion of the dorsal. Pectoral fins longer and more pointed than in most of this family of fishes. Tail a little concave. Lateral line nearer the back. Colour of the back a rich brown, in many examples throwing off bands which pass to the belly. The sides a pale red, saffron-coloured, or yellow, usually fainter below. Two or three waved parallel whitish or faint blue lines pass along the sides from head to tail, except that the lowest ends near the posterior border of the anal fin. On the gill-cover are several faint blue stripes running obliquely downward and backward. The fins are striped lengthwise, with red and yellow; the tail often mottled or striped with the same colours. Pectorals and ventrals yellow.

Fin rays—dorsal ten and fourteen, pectoral fifteen, ventral six, anal two and seven, caudal seventeen.

DUSKY PERCH.

Serranus gigas,	Cuvier.
" "	Yarrell; Br. Fishes, vol. i, p. 14.
" "	Gunther; Cat. of Br. Museum, vol. i, p. 132.
Holocentrus Merou,	Lacepede. Risso.
Perca robusta,	Loudon's Mag. Nat. Hist., vol. v, p. 21.
Perca gigas,	Jenyns; Manual, p. 333.

This, which, as its scientific name implies, is among the largest of the species of this family, and is not uncommon in the Mediterranean, appears to have been overlooked by naturalists until very recent times, and even yet its peculiar habits have been but little examined. Risso tells us only that it comes to the neighbourhood of Nice in summer and autumn. It appears that the south part of the coast of Cornwall is the north boundary of its wanderings, as it is of several other fishes of the west portion of the Mediterranean; but even there it is found but rarely, and no more than three or four examples have fallen within the notice of naturalists. The first of these was taken near Polperro with a line, and from it our figure and description were obtained. I learn from W. P. Cocks, Esq., that two others have been brought into Falmouth, and one of these was presented by him to the collection of the British Museum. One, if not more, has been obtained at Penzance, but of its habits on our coasts we have nothing to report.

At first view this fish has more the appearance of belonging to the genus *Labrus* (the Wrass) than to the family of Perches; and, in conformity with this, it is said that in Spain, where it is well known, its name is the same as that of the Wrass; but closer observation corrects the mistake, and shews it to be possessed of the proper characters of the

DUSKY PERCH.

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large family of Perch-like fishes, to which therefore we are led to infer that its habits also belong.

The example described was taken with a hook. It measured three feet in length, and was seven inches deep, exclusive of the fins; the body thick and solid; the weight sixteen pounds: but it is sometimes found much larger. The under jaw longest, and both, as well as the palate, with numerous slender incurved teeth; a bed of them in front of the lower jaw. Lips resembling those of a Codfish; two large open nostrils, and a large hole under the projection of the nasal bones. First plate of the gill-covers serrated, the second with a broad flat spine projecting through the skin and pointing backward. The fleshy covering of the gill-covers lengthened posteriorly. The body and head covered with large scales. Lateral line gently curved. Dorsal fin single, long, expanding towards its termination; the first spinous ray short, the two last soft rays from one root. Pectorals round; ventrals fastened down with a membrane through part of their course; vent an inch and a half beyond the origin of the anal fin. Tail round. Colour of the back reddish brown, lighter on the belly. Two slightly-marked pale lines on the gill-covers, one on each plate, running obliquely downward.

This fish must sometimes attain an enormous size. A figure of the natural size of the head of an example taken at Penzance, of which the body unfortunately was destroyed, measures one foot four inches from the front of the jaw to the hinder portion of the gill-cover, and in depth, immediately in front of the dorsal fin, thirteen inches.

POLYPRION.

A SERRATED border to the first gill-cover, a strongly-ridged spine high on the second gill-cover, and a rough crest above, with roughness over the bones of the head. Firm scales over the body, cheeks, and mustache. A single dorsal fin, in two portions; the second, with the anal fin, much developed.

STONE BASS.

Wreckfish,	Transactions of Linnæan Society, vol. xiv, p. 81.
Scorpæna Massiliensis,	RISSO?
Polyprion cernium,	CUVIER.
Couch's Serranus,	YARRELL'S British Fishes, vol. i.
" "	GUNTHER; Cat. British Museum, vol. i, p. 169.

IT is remarkable that this large and well-marked fish should be among those which have remained unknown to naturalists until very recent times; although, if the reference made by Dr. Gunther to Risso, as given above, be correct, it is far from being rare in the Mediterranean, where it is held in esteem for the table.

With us, on the south and west coasts of the kingdom, it is well known to fishermen, and especially as coming under extraordinary circumstances. It may not have been noticed for several years; but when a mass of wood or fragment of wreck, covered with Bernacles, (Lepades,) is driven into our waters from the direction of the Atlantic, a considerable number of these fishes is often found to accompany it, as if it were a special point of attraction to them; for in the most sportive manner they gamble round it or over it as it rolls by the action of the waves, so that I have known their tails excoriated by rubbing against its substance; appearing to chase each other as they feed on the small fishes or crabs which have

STONE BASS

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sought shelter among the suspended bernacles or weeds, which float in masses in connection with the wood. That they do not themselves feed on the bernacles is plain, for I have never found them in the stomach; but what cause should lead them to come to us under such circumstances, or as is reported to have happened in some rare instances, where the bottom of a ship has been foul from the same cause, appears difficult to be explained; as is also the fact that so large a number should be thus attracted, when they are reported in the Mediterranean to be of solitary habits.

So familiar is the opinion that such a mass of floating wreck in the northern portion of the Atlantic is usually accompanied with a multitude of these fishes, that I am informed, when it floats within sight of a ship and the weather is favourable, a boat is often sent with the expectation to obtain some of them, which is done by piercing them with a spear usually employed by sailors for such an object, under the name of grayns. So many as thirty-five have been secured at one time by a single boat on our own coast. It is agreed on all hands that they form an excellent dish at table.

Of a considerable number of these fishes which have come under my observation I have never met with more than one example that has exceeded, or even reached the weight of twenty pounds. But on the evidence of Cuvier we gather that in the Mediterranean they sometimes so vastly exceed this, as to be met with of a hundredweight; and it is from this circumstance chiefly that I am led to believe it likely to be a fish long lost to science, but known to the ancients, and mentioned by Oppian under the name of *Etnaian cantharus*, an epithet which Scaliger pronounces to have been applied to the fish on account of its great size. The particulars leading to this supposition are but few, and perhaps obscure, but they agree with the characters of the fish as known in its native haunts; and although Ovid designates it as

"Cantharus ingratus succo,"
"The Cantharus of unpleasant flavour,"

this may have depended on the mode of cookery, or the taste of the eater; and that it was fished for as a valuable

prize, appears as well from Oppian's direct assertion, as his description of the fishermen's proceedings, which involved no little skill and patience. He first made a vessel or chamber of wicker-work with a large door, not unlike the larger lobster store-pot now employed to secure these crustaceous captives after they have been caught. These he baited with roasted crabs or cuttlefish, and placed it near the rocks frequented by these fishes, with the door in the side left open. The fishes would gradually collect together, but he was in no haste to obtain them, and continued to furnish new bait as it became devoured by the fish; for his object was, not only to secure at one haul a large number, but by feeding to fatten them as much as possible. When everything had succeeded the door of the trap was closed, and the capture secured.

The example described was eighteen inches long, and six deep, exclusive of the fins; body thick and stout. Head bony, a high ridge on the gill-covers; teeth in jaws and palate small, numerous; border of each plate of the gill-covers serrated; also a large bony serrated plate at the origin of the body, above the gill-covers. Scales firm, over the body. Dorsal fin long, expanded towards its termination, with eleven spinous and twelve soft rays; the two last from one root. Pectoral fin with fifteen rays; in the ventral six, the first a strong spine, with short spinous processes along its outward edge. Anal fin with twelve rays, of which the first three are spinous. Tail straight.

DENTEX.

LV

DENTEX.

Cuvier places this genus within his family of *Sparoides* or Sea Bream-like Fishes, which he divides into generic sections, principally according to the situation or structure of their teeth; a ground of division which might appear slight if it were not that the number of species in this family is so great, that confusion must follow if some means of separation were not adopted by which sections of them could be kept distinct. The generality of naturalists have been content to follow Cuvier in this arrangement, and the appearance of the only species we know seemed to warrant it; but Dr. Gunther, in his "Catalogue of the Fishes of the British Museum," has placed the genus far away from those with which it had been associated, so that even the Surmullets are permitted to stand between. Without attempting to pronounce an opinion on this last arrangement, regarded in the light of a connection or separation of affinities, we are content to follow it for a species which is the only one we have of the genus, and which can only be considered a stranger on our shores.

According to Cuvier the genus *Dentex* is characterized by having conical teeth, even on the sides of the jaws, and generally in one range; and those immediately in front are lengthened into large hooks. The cheeks have scales; the edge of the first gill-cover even, or without notches.

DENTEX.

Four-toothed Sparus,	Jonston; Article 6.
" "	Willoughby; p. 312, tab. v. 3, *Dentex, Synodon, Synagris.*
Sparus dentex,	Linnæus. Donovan; pl. 73.
Dentex vulgaris,	Cuvier. Jenyns; Manual, p. 357.
" "	Yarrell; Br. Fishes, vol. i, p. 127.
Spare denté,	Lacepede. Risso; p. 251, and *Dentex cetti.*
" "	Gunther's Cat. of Br. Museum, vol. i, p. 366.

This fish is well known through the whole length of the Mediterranean, and is distinguished for its large size as compared with others with which it has been usual to associate it; as well as by its rapid growth, and eagerness in pursuit of prey, to which its long and formidable teeth render it a

destructive enemy. It has been classed amongst British fishes from the circumstance that Donovan, when engaged in publishing his "Natural History of British Fishes," had the good fortune to obtain a specimen which had been caught near Hastings, and of which he has given a characteristic figure. To the present time this has been the only record of its having wandered so far to the north as our coasts; and therefore it is with pleasure I am able to report the occurrence of two other examples, for the knowledge of which we are indebted to the vigilance of W. P. Cocks, Esq., of Falmouth.

Risso appears to convey the impression that in its native climes it is common only for two or three months in summer; and the rarity of its occurrence with us shews how little it is accustomed to wander, at least northward, from its usual haunts. Willoughby found it in the market both at Rome and Venice.

We obtain our figure of the conspicuous front teeth of this fish from a preserved skin in the British Museum; but never having had a recent example to refer to, I prefer to copy the description from the "Icthyologie" of Risso, coupled with the "History of Fishes" by Willoughby, both of these having been derived from examination of recent specimens; but I am assisted further by notes from observations made on the last-named British examples by William P. Cocks, Esq.

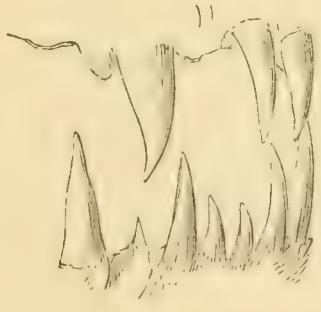
The Cornish specimen, first referred to, was two feet eight inches and a half in length, five inches in breadth, and between seven and eight inches in depth, and was purchased in the market at Falmouth by J. Vigors, Esq., in November, 1846. The second, which came to the same market in August, 1851, was still larger, and measured four feet eight inches in length, and therefore probably was an old fish of the full size it ever reaches, the four long, conical, and projecting front teeth being much worn and discoloured. Du Hamel is quoted as having known it to weigh thirty-eight pounds, and Risso gives about forty inches as the usual length. In its general aspect it bears a resemblance to the Becker or Common Sea Bream, but the proportions are described as rather longer and more solid. The back is also elevated and thinner, and the lower jaw rather longer. The teeth are in a single row, and the front teeth so prominent as to afford a distinctive character

to the species, and even genus. The head is flat on the top and the eyes high on the cheek. Scales on the body and gill-covers large. The lateral line passes nearer the back, and decends towards the tail. Pectoral fin long and pointed; tail concave; dorsal fin a little expanded at its end; anal fin rather short.

In regard to colour Risso represents it as beautifully varied, and in this he is supported by Willoughby. He says the general hue is silvery, interchanged on the back with light blue, and having blue spots on the sides. In front of the head there are waves of golden yellow, silver, and amethyst; the eyes blue, with a golden iris. The dorsal fin a bluish yellow; pectorals reddish; caudal a fainter red. Willoughby describes the back as green or yellow, in the large examples inclining to purple, dotted over with clouds of blue and dark, the colour extending to the sides. At the roots of the hindmost rays of the dorsal fin a black spot, as there is also at the origin of the pectoral fin. Ventral fins yellow.

A large example seen by Willoughby was red all over, with a shade of purple; but the specimen represented by Donovan, which we have figured, is of a more subdued colour than is described above, as indeed might be expected from the more cloudy skies and lower temperature of the water of our more northern regions; for, as we have had repeated opportunities of remarking, such fishes as wander to us from the Mediterranean, are usually destitute of the brilliant tints which adorn them in their native seas.

The fin rays are differently numbered by different writers; but we give them as collected from Risso:—Dorsal eleven spinous and twelve soft; anal three spinous and eight soft; ventral one spinous and five soft; pectoral fourteen, caudal eighteen.



Front Teeth of Dentex.

MÆNA.

The body compressed and covered with scales; the upper jaw capable of being extended and drawn backward by means of a process of bone, which passes upward between the eyes. In consequence of this structure, the mouth, which when closed looks small, is capable of assuming a wide gape. Teeth in the jaws very fine, in a narrow band, and also a like band lengthwise on the middle of the palate (vomer.)

MENDOLE.

MACKAREL.

Mœna,	Jonston; Articulus 21.
"	Willoughby; p. 318, tab. v. 8.
Sparus mœna,	Linnæus.
Mœna vulgaris,	Cuvier.
La Spare Mendole,	Lacepede. Risso; p. 239.
" " "	Gunther; Cat. of Br. Museum, p. 386.

This is a common fish in the Mediterranean, and in many places is found in great abundance, especially in the neighbourhood of Venice; but it has very rarely been met with in any part of the Atlantic, and it becomes therefore the more remarkable that it should have been found in the British Island. I am indebted for the information of such an occurrence to William P. Cocks, Esq., from whom I learn that a single example was caught at St. Mawes, within the harbour of Falmouth, in a net, in which were also enclosed some Grey Mullets. Unfortunately no figure appears to have been taken of this only English specimen; but the description presently to be given, which I owe to the kindness of Mr. Cocks, will leave no doubt that he is correct in his appropriation of the name.

In its native waters the Mendole is an exceedingly prolific

fish, and usually keeps near the land in places where sea-weeds abound, feeding on them, as well as enjoying their shelter, but not refusing to take a bait. Oppian says—

> "Close to green shores the watery natives feed,
> That hide in wreck and bite the spiry weed.
> Such food the Cackerels and the Goats approve."

They were never held in reputation for the table, and anciently were considered as food only for the lower orders of society. Martial terms them "inutiles mænas," worthless Mendoles; and another poet, describing a poor dinner-hunter, represents him as disappointed in his search, and then returning to satisfy his hunger on these fishes. Hence it was a proverb at Rome that they only were indifferent to the pleasure of the table who would as soon dine on a Mendole as on Sturgeon; yet our countryman, Willoughby, represents them as agreeable food: but the discrepancy is explained by Lacepede, who says that when in their best condition they are not to be despised, and that the females in full roe are delicious. The principal use made of them in ancient times was as sauce for other fishes, and this we learn to have been formed chiefly from their entrails.

Mr. Cock's description of the Cornish example is:—The body oblong, compressed, and covered with large scales: the mouth small and protractile; jaws with a narrow band of minute fine-pointed teeth, densely packed together; a longitudinal band of the same along the middle of the palate (the vomer.) An elongated scale above each ventral fin, and one between these fins. Eyes large. Upper surface of the body dark lead grey, with bright silvery sides and belly. The length nine inches and a half, depth two inches and a quarter. But the most remarkable circumstance that belongs to this fish is its great diversity of colour in different places and seasons. Lacepede says it is generally white, with blue stripes along the side; a long dark spot on the side, above the vent; the fins red: but the colours become more lively in summer, and are generally so on the coast of Africa. Willoughby describes the colour as pale green or dusky yellow, with blue lines, and a large round dark blotch on the side, with spots and lines running obliquely over the

whole body, but especially on the back and head; and he particularly points out four teeth in the lower jaw that were larger and longer than the others. Observers who have been well acquainted with this fish in one district, have felt themselves at a loss in consequence of this diversity of appearance, to recognise it in another.

Fin rays, with some difference of enumeration by different writers,—dorsal eleven spinous and twenty-three soft; pectoral fifteen; ventral one spinous and five soft; anal three spinous and nine soft.

The figure we give is taken from Willoughby's "History of Fishes."

SURMULLET.

XLVII

MULLUS.

Head compressed, and sloping in front; body thick and solid, together with the cheeks covered with large scales, which are easily displaced. Jaws slightly furnished with teeth, or not at all. Two barbs at the origin of the throat. Two fins on the back, which are separate. First gill-cover having its border smooth. Thoracic fishes.

SURMULLET.

Mullus,	Jonston; Cap. 1, Art. 1, *M. major*, table 17, f. 6.
"	Willoughby; p. 285, tab. S. 7, f. 1.
Mullus surmuletus,	Linnæus. Cuvier. Bloch, pl. 57.
" "	Donovan, pl. 12. Fleming; Br. An., p. 216.
" "	Jenyns; Manual, p. 337.
" "	Yarrell; British Fishes, vol. i, p. 30.
Mulle surmullet,	Lacepede. Risso.
" "	Gunther's Cat. Br. Museum, vol. i, p. 301.

The Surmullet is a common fish along the coast of the south and west of England, and is known in Ireland and Scotland, and even much farther north where such ground occurs as is fitted to its habits. But if a fish can be said to have its chief residence where it attains the largest size and liveliest colours, that favourite district is the west portion of the channel which divides England from France. It may be termed a fish of passage, so far as a change from the deeper water of the middle of the channel to its borders, according to the season, will allow of its being thus characterized; for, while it is not unfrequently taken in a trawl net at a great depth in winter,—and on one occasion a trawl vessel of Plymouth at that season took so many fish, of which Surmullets formed by far the largest portion, as were sold for twenty pounds,—they do not come within the reach of the trammel or ground-sean until about the month of May; and,

although it is the habit of this fish to keep close to the bottom, the change of place is effected by swimming near the surface over a large depth of water, by doing which it often becomes entangled in the drift-nets set at a distance from land for the spring approach of Mackerel.

The trammel-net, which is chiefly used to take this fish near the coast, is formed of three parallel nets set to one head and foot line, with meshes of some considerable difference of dimensions in the separate nets, the middle one having the distance from knot to knot just sufficiently large to receive the head and forward part of the fish, while the outermost net on either side, which hangs a little more loosely, has its meshes sufficiently large to allow of the passage of the body of the fish until it has felt itself arrested in its course; at which time its struggles call the larger meshes into action to form a bag or entanglement, by which the captive fish is prevented from falling out and being lost when the net is drawn to the surface. This net is set in places known to fishermen, where the ground is oozy, with scattered stones; and it is proper that the foot-rope should rest on the ground, for the fish is disposed to find its way under it in seeking its food, which is the smaller kinds of crustaceous animals and worms, which rest on the ground; with perhaps sea-weeds. Its stomach is thick and firm, and I have also found in it fragments of a shell resembling the class termed a Venus; but it was an opinion of ancient times that this fish fed on, and even gave a preference to, every foul and loathsome substance, among which putrid fishes, and even the human carcass, stood pre-eminent. Oppian says,—

> "Of all the kinds that range the spacious flood,
> Luscious Surmullets seek the coarsest food.
> In beds of slime they roll with wanton ease,
> And cull the grossest ordure of the seas;
> But shipwrecked men, (detested sights of woe,)
> The richest course of luxury bestow;
> Whatever baits a nauseous smell diffuse
> With sure success commend their constant use.
> Swine and Surmullets seem alike inclined,
> Mean in their choice, their palates unrefined;
> But none that yield a more delicious food
> Or haunt the forest or divide the flood."

In proof of their alleged fondness for human flesh it has

been remarked that they have been found to assemble in larger numbers after a great battle at sea. Happily it is out of our power to confirm or deny this last alleged fact; but an inspection of the mouth of this fish, so small and toothless, renders it incredible that at any time the human body or any large object should be the subject of its appetite. That it will take a hook, however, is familiarly known, although this does not appear to be usual until the decline of summer, when it enters harbours and is fished for from rocks and piers.

The Surmullet is well furnished for searching out its prey by the possession of a pair of barbs, which hang below the middle of its lower jaw, and are endued with quick powers of sensation, residing in nerves, one in each of the pair, which pass along their outer side, and, next to the nerves of vision, are the largest in the body. The barbs themselves are so placed, that when the fish rests upon the ground or passes along, they can be lifted up and hid between the bones of the gills; but they are in such a manner attached to a frame-work of bones separate from the jaws, but united to them by ligament at one end, and are acted on by muscles of such considerable power, as to be capable of acting in every direction in the examination of neighbouring objects.

Ancient writers were so fully persuaded of its producing spawn three times in the course of a year, that they gave it the name of Triglé from that circumstance; which name has however, in modern times been bestowed on another genus of fishes; and they believed the selected place to be near the mouths of large rivers. We see, however, but little signs of its breeding on our coasts.

The Surmullet is now, as it ever has been, an object of enquiry to those who indulge in the luxuries of the table, so that it became a proverb, that those who caught it never knew the taste of it; but to obtain it in its perfection it ought to be in the hands of the cook within a few hours after it has been taken from the water. The ancients were aware of this, and it was something more than curiosity which led the Romans to produce the living fishes on the table for the inspection of the guests, before they delivered them to the cook. Seneca tells us they were scarcely valued unless they had died in presence of the guests. Those which with us

are caught in a trawl, from the loss of their scales and bruised condition, are still more prone to decay than such as are taken in the trammel; and care in this respect is the more necessary, as a large portion of their rich flavour depends on the particular manner in which they are cooked. It is necessary that the entrails (and especially the liver) should remain within the fish when they are roasted or baked, and they are rolled in paper to protect the skin from being unduly scorched with the heat,—a mode of preparation, which, it is not a little remarkable, has been practised for at least two thousand years; as we learn from Ælian, who says that it was the custom to roast them, and that skilful cooks professed to hinder the belly from bursting by kissing the mouth of the fish.—B. x, C. 7.

In no article of luxury does it appear that the Romans of the empire went to such extravagant, and even ridiculous extent as in regard to this fish; but that there is no exaggeration in the statements of the poets, appears from the corroboration afforded by the sober relations of the moralists and historians. The utmost pains and cost were bestowed on the formation of ponds for preserving these fish, and thereby having them always at hand; but unhappily success did not always attend the effort, and Columella (De re Rustica, B. 8, C. 17,) informs us that when caught,—it must be supposed in what we now term a ground-sean—and turned into the pond, scarcely one in several thousands survived to reward the care bestowed upon them. This loss he ascribes to the nobility of the fish, which spurned confinement; but we can more readily impute it to the stagnant nature of the water, which admitted of little change in a place where there existed only a very small influence of the tide, and which therefore experienced renewal only from the uncertain influx of waves when the wind might chance to blow high and in a favourable direction. We speak of the Surmullet as having been the subject of so much extravagant attention, but there is reason to believe that what we shall presently find occasion to mention, applies more directly to the plain Red Mullet;—the next in order in our arrangement, and much the most abundant along the coasts of the Mediterranean, rather than to the larger and more ornamented fish which chiefly abounds in Britain. But there was little

discrimination of nearly-allied species even among the most observant writers, in ancient times; and we have reason to believe also, that in some of the stranger tales handed down to us, the larger, and to us more familiar fish, was truly that to which the narrative refers.

Besides the enormous cost that was unavoidable in the formation of some of the fishponds into which salt water was admitted, the expense was scarcely less for preserving those which survived the capture in that healthy condition in which it was necessary they should appear if carried to the market; for it caused their owner to be subject to sharp criticism if any marks of neglect or under feeding could be noticed in them. We are informed that in his private ponds Hortensius was accustomed to employ a large number of men in attending to the wants of his Mullets by supplying them with small fishes; and they were supplied with salt fish when boisterous weather proved a hindrance to his obtaining food from the sea. Lucullus is sufficiently known for the great expense he was at in forming his ponds, and especially for the enormous cost of digging through a hill, to obtain a passage into them for the water of the sea; and yet he was blamed by Hortensius for want of care in allowing his fish to remain in what he considered an unhealthy situation. He declared that he would bestow more attention on his sick fishes than on his sick servants; and this care of his extended to the furnishing them with water artificially warmed, while his sick servants were left without any such conveniency. He would even be better reconciled to the loss of one of the chariot-mules from his stable than that he should lose a Mullet from his pond.—(Varro, De re Rustica, B. iii, C. 17.)

Nor was this feeling to be ascribed to the merely pecuniary value of these fishes, although the prevalence of fashion was such, that those who were desirous of having a name among the high and noble, and for that purpose of making a display of luxury, were ready to pay an extravagant price for the coveted dish. Martial has an epigram on one who sold a valuable slave, that with the price he might for once thus indulge himself, and be talked of, although, in fact, he gave his guests but little else to eat. And we hear of another of these apes of the rich and the noble, who would not be without

a dainty so much esteemed, but who contented himself with half of a fish, as all he was able to supply. Under these circumstances the price might be expected to rise very high, and accordingly a Mullet of two pounds (each pound amounting to twelve ounces) was expected to bring its weight of silver. This value, however, was often exceeded, and especially perhaps when the fish had grown scarce in their own waters, and in consequence were sought for on the distant coasts of Corsica and the south of Sicily. At that time a thousand sesterces were equal to three pounds of silver, and, according to this reckoning, Juvenal speaks of a single Surmullet as having obtained the price of almost fifty pounds; and if as a satiric poet he may be suspected of exaggeration, his story is confirmed by the more sober Suetonius, who tell us that on one occasion three of these Mullets were sold for thirty thousand sesterces, which made at least seventy pounds for each fish. Juvenal remarks on examples of this nature, that the fisherman might have been bought for less money than his fish; and, according to Pliny, so might, in former days, the cook that dressed it.

According to the last-named author, Asinius Celer expended sixty-five pounds in the purchase of a single Mullet; which will render less extraordinary a story told of the Emperor Tiberius, in which instance the price obtained will be ascribed to the wish of contending courtiers to obtain the notice of their prince, rather than to the fashionable value of the fish itself. It appears that some one had obtained a Mullet which reached the unusual weight of four pounds and a half, and which he judged a proper present for the emperor; but the latter, either from avarice or caprice gave command that it should be carried to the market for public sale, where two noblemen contended for the purchase until it reached the sum of five thousand sesterces, or fifteen pounds of silver. But people of a lower degree had similar aspirations; and an Egyptian, who had been a slave and had obtained his freedom, and afterwards been raised to the rank of a knight by the Emperor Domitian, was rich enough, as well as sufficiently ambitious, to pay six thousand sesterces for the fish. And yet, stranger still, all of these examples must give way to what is told of the Emperor Heliogabalus, who, in a freak

of ostentation as we must suppose, indulged himself with a dish which was formed of only the barbs of this expensive fish.

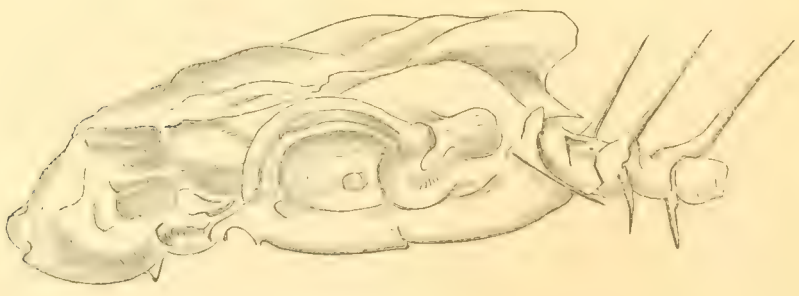
The head and liver were the parts which constituted the particular objects of attraction to those who prided themselves on their taste: and that the last-named part was such we can easily understand, whether formed into sauce or as a portion of the cooked fish, for in truth it is this which yields the larger portion of its delicious flavour. But it is not so easy to discern what it could be that recommended the head to the epicure, except that so little of anything could be extracted from it. The well-known Apicius, who spent a large fortune in the indulgence of his appetite, believed that he had secured an addition to his luxuries by drowning Mullets in a rich sauce of great cost, known by the name of the Sauce of the Allies, and supposed to be made of the entrails of Mackerel infused in very strong vinegar. But it is easy to perceive that fancy only, or the craving after notoriety, so powerful in his day, must have been the chief inducement to this proceeding; for the fishes could not receive any portion of the flavour into their flesh until they were dead.

The practice of presenting the living fish to the guests at table, swimming in glass vessels, which had its origin in the wish to secure them in the best condition for the cook, became afterwards a fashion; and there were those who found a pleasure in pointing out the succession of changes through which the captive passed as the powers of life declined. The Surmullet is one of those fishes which after death never recover the brilliant tints which adorn them during life, and when at freedom in their native seas.

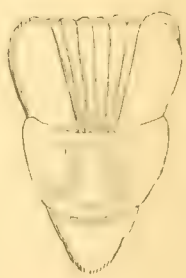
It is curious to find that there were some who probably acquired equal notoriety with others, and at the same time saved their purse, by professing to despise the fish which others so greatly coveted. Bœticus, as Martial speaks of him, could not eat the Mullet, the hare, the boar, the pheasant, nor other dainties; but he preferred the Gerres and other fishes, which held the same value as with us the Sprat; and Martial declares for himself that although he valued a Mullet of two pounds weight as equal to a Turbot, yet both these fishes lost their relish when alloyed by the prate of his entertainer.

I have known a Surmullet to measure sixteen inches in length, but being thin in flesh it did not exceed forty ounces in weight. The form is but a little compressed, and flattened on the belly. The eyes elevated; head proportionally large, sloping gradually, and in a waved outline to the mouth. Upper jaw a little the longest; teeth in the lower jaw only; a roughness, rather than teeth, in the palate; two long barbs beneath the lower jaw, which are received into a depression beneath. Several mucous orifices between the upper jaw and eye. The back elevated; body and cheeks covered with large scales, which are easily removed; those on the lateral line perforated, having a rayed ridge in their longitudinal direction: this line is gently curved. The first dorsal fin with spinous rays, which gradually shorten from the first; second dorsal opposite the anal; the first ray of the former spinous, the latter fin nearly triangular. The pectorals narrow and pointed; ventrals long and wide; tail concave.

The colours are subject to some variation, but are always rich and brilliant, but more so in life than after death. The back, head, and generally the fins, red or scarlet, which is softened on the cheeks and sides, and still fainter on the belly; along the sides four yellow stripes, the lowest reaching only half the length of the body. The anterior dorsal fin with a broad diagonal stripe of bright yellow. Of five of these fishes caught together, four were of the more usual colour, but the fifth was much the most splendid in its appearance, the belly being also of the most brilliant crimson. The lines on the sides were scarcely to be discerned, but as life declined the colour became more faint, and the lines became conspicuous as in the others.



Skull of the Surmullet.



Pectoral scales.

RED MULLET.

PLAIN RED MULLET.

Mullus minor,	Jonston; Capud 1, Art. 1, Tab. 17, f. 5.
" *barbatus,*	Willoughby; p. 285, tab. S. 7.
" "	Linnæus. Cuvier.
" "	Jenyns; Manual, p. 338.
" "	Yarrell; British Fishes, vol. i, p. 36.
Le Mulle Rouget,	Lacepede. Risso. Gunther's Catalogue of British Museum, vol. i, p. 401.

The Red Mullet appears to be most common in the Mediterranean, although Risso seems to remark the contrary; but it was certainly the species to which many of the anecdotes of ancient writers, which we have given when speaking of the Surmullet, most frequently apply. On our own coasts, however, it is a rare visitor, so that when an example is met with it is thought deserving of special notice. Yet it has been taken at the two extremes of the kingdom, for while Mr. Cocks records it as met with at Falmouth, Dr. George Johnston has published the notice of one obtained by himself on the coast of Berwickshire.

In its general shape, and, according to Dr. Gunther, in the frame of its bones, it bears a near resemblance to the Common Striped Surmullet, insomuch that some have supposed the former to be only a variety of the latter. It may happen, perhaps, that the mere circumstance of colour will not prove sufficient to distinguish them; for, although the Red Mullet may never display the well-marked stripes commonly found in the Surmullet, it has been observed that the latter (at least during life) may chance to have them concealed by the brilliancy of its other colour. But although the colour of

each usually may be red, we gather from the words of Ovid that its hue is not commonly the same. That of the Surmullet we know to be lively in a high degree, but of the plain red species the poet says,—

"Squalus tenui suffusus sanguine Mullus;"
"The dull-coloured Mullet that has a slight tint of blood shed over it:"

an observation supported by Willoughby, who says the colour is a dull olive yellow, except when the scales are lost, when it becomes more decidedly red. It should be added, however, that in the edition of Aldus the word 'squamus' is substituted for 'squalus,' as if the scales were suffused with the tint of blood.

But a more positive evidence of their being distinct is found in the general characters of form and relative situation of the fins. By reference to figures, and especially to that of Willoughby, which, for want of an opportunity to draw from a fresh example, we have thought it best to copy,—as well as to his description,—we find the head descending much more abruptly from before the eyes to the jaws. The first dorsal fin also is further in advance of the pectorals, while the ventrals are placed further behind. At full growth it is smaller than the Surmullet, and, while more abrupt in front, the hinder part of the body grows sensibly more slender.

Fin rays—first dorsal seven, (the first very high,) second dorsal nine, caudal seventeen, anal seven, pectoral sixteen, ventral six.

This species anciently received the designation of *Barbatus*, or the Bearded, in contrast with another fish, supposed to be nearly allied to it, and which by way of further distinction, received the name of *Mullus imberbis*, or the Unbearded Mullet, as being destitute of those appendages to the jaws. Modern naturalists have judged more correctly of the natural affinities of these fishes, and in consequence have placed the latter in another genus; which, however different in many respects from the true Mullets, they have, with some inconsistency, agreed to call by the name of *Trigla*, which anciently, and for an assigned reason, was only applied to the former fishes. But it is proper we should add that the error of re-

mote times, in classing together the so-called *Mullus barbatus* and *M. imberbis*, will not be found without some excuse; for these two fishes bear considerable resemblance to each other in their general form and colour, as well as habits, and the latter is often caught in the same net with the Surmullet; added to which, when taken it is usual for the barbs of the Mullet to be drawn beneath the throat, thus rendering the resemblance still more close.

The existence of the three processes or fingers near the pectoral fins in the Streaked Gurnard, might, indeed, have been sufficient at any time to point out the generic difference between them; but it had not that effect even with such observant and systematic naturalists as Artedi, Linnæus, and Gronovius, who have agreed to class this fish with the Gurnards, *(Trigla,)* although Willoughby and Ray had long before marked the distinction between them.

THE SPAROID FAMILY, OR SEA BREAMS.

These fishes are compressed in the form and proportions of their body and cheeks, with a tendency to an oval in the outline; the cheeks and body firmly clothed with scales, but not having them extended over the fins. Anterior portion of the dorsal fin with spinous rays, the hinder portion having soft and branched rays. The jaws usually or nearly equal, but the teeth subject to much variety; and as the species are numerous, a large part of which inhabit warmer climates than our own, naturalists have found it necessary to divide them into several sections or genera, which is most conveniently done according to the form and arrangement of their teeth. It is the consequence of this that there exists a near affinity between these several genera, and that, indeed, it often happens there is less difference in the characters of some of the genera than is found between the species in other departments of nature.

As is the case with other fishes which come to us from warmer or brighter seas, either as periodical or wandering visitors, they are subject to change of colour, and remarkably so when in their highest condition, as compared with their emaciated or lower state. And as it is not always convenient to destroy a specimen, which must often be done if we wish to examine the full course of the teeth, it need not surprise us if it happen that the rarer species have not been always clearly recognised; and consequently that they have not been in every case referred to the proper synonymes, as designated by other observers. Such mistakes have been laid to the charge of some of our most careful authors; and it is in order that I may keep clear of the misfortune of increasing such errors, that, in describing the species which have been recorded as occurring in Britain, my references to others, and especially to foreign writers, will be less frequent than usual, or as might

otherwise be desired. Our dependence, on the contrary, will be chiefly on our own resources; so that we shall not give any figure or descriptions of the members of this family, even to the risk of an omission, except of such as have fallen under our own inspection: or if in any case a reference is made to another writer, it will be in such a manner that the borrowed matter may be easily separated from our own.

The fishes of this family are classed together as thoracic fishes by Linnæus, and both the Swedish naturalist and Cuvier have included in it the genera *Dentex* and *Mæna*, which we have followed the example of Dr. Gunther by placing in a separate family.

CANTHARUS.

The body elevated and thick; muzzle short. Jaws not protractile; teeth fine, short, and dense, the outward row strongest.

OLD WIFE.

BLACK SEA BREAM.

Cantharus,	Willoughby; p. 309, tab. v. 1,
Sparus cantharus,	Linnæus.
Cantharus griseus, C. vulgaris,	Cuvier.
" " "	Yarrell; Br. Fishes, vol. i, p. 130.
" " "	Jenyns; Manual, p. 358.
Pagrus lineatus,	Fleming; Br. Animals, p. 211.
Cantharus lineatus,	Gunther; Cat. Br. Museum, p. 413.

This is a common species on the west and south coasts of England and Ireland, but as it is a solitary fish it can scarcely be called abundant. It is with us in summer and autumn, at which time it is caught, in common with the other species of this family, with the common baits used by fishermen, but of which the mussel is perhaps the most successful. It also feeds on the finer kinds of sea-weeds, upon which it becomes exceedingly fat. I have known it caught so late in the year as Christmas, and in one instance, after a cold season, an example came to hand in the middle of February, with the roe well developed. In this instance at least it would have bred on our own coasts, which is not usually the case, so that it is not often met with of less size than the usual full growth. It seems to prefer rocky ground, and is sometimes taken in harbours, by fishing from the shore.

With us it is scarcely admitted to genteel tables, but in

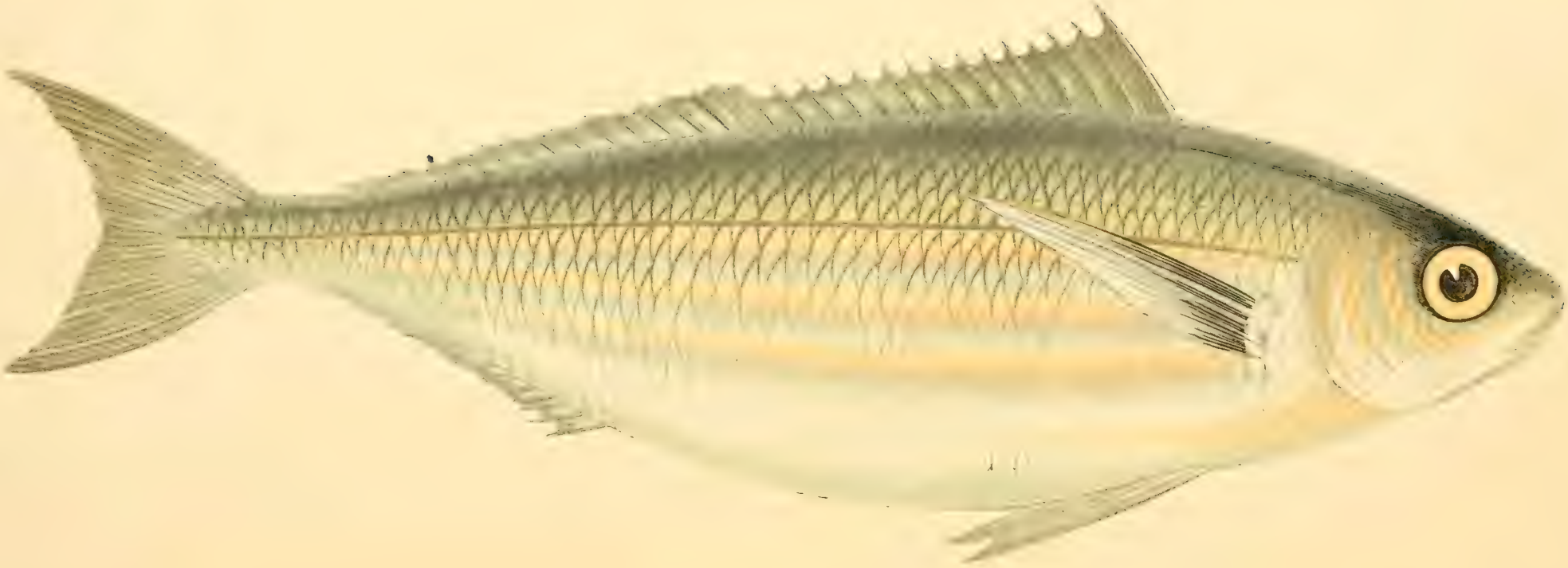
ancient times it appears to have been an object of attention, since Oppian describes the kind of trap termed nassa, or wicker pot, as used specially for taking it. The males were supposed to associate each with his own female for life. This species is widely distributed, its range extending at least from Scotland to the Island of Teneriffe, and through the Mediterranean.

The translator of Oppian follows Gaza, who translated Aristotle's name of this fish by the corresponding English word Beetle, and this name, however uncertain, is still continued as the designation of the genus in which this fish is classed. I have assigned it the name by which alone it is known to the fishermen with whom I am acquainted; and, although this name may be objected to as being also applied to a foreign fish of a different family—the *Balistes vetula*, the latter probably having received its English name of Old Wife from some supposed resemblance it bears to the *Cantharus lineatus*—yet the name I give it is less objectionable than that of Black Sea Bream, since the latter is not in any case descriptive of its colour, as will appear from our description.

The example described was sixteen inches in length and five in depth, exclusive of the fins. The general form compressed, but solid; mouth rather small, and the under jaw a little protruding; the teeth crowded, slender, erect, with some molar teeth behind. Eye rather small, lateral; a large single nostril a little before it, and another close to the angle of the mouth, under the projecting bone. The head rises considerably, and still more the back to the dorsal fin; cheeks and body covered with scales, firmly fixed, and of moderate size. Lateral line arched, conspicuous. The dorsal fin begins above the root of the pectoral, and both it and the anal become wider posteriorly; the three last rays of the former and two of the latter severally from one root, and bound down; pectorals broad at the base, long, and pointed, and the roots of the rays clothed with scales; tail concave. The colour is liable to much variation, according to the season and health of the fish. When most lively the cheeks are flesh-coloured; top of the head, round the eyes, and part of the cheeks a rich brown; summit of the back obscurely green; behind this and over the body reddish yellow, with irregular dark brown lines. A

single example in the month of September was a uniform pink colour; but when the colours fade this fish becomes of a dull and sooty tint.

Fin rays—dorsal eleven to thirteen, pectoral fifteen, ventral six, anal three to eleven. Between the ventral fins is a loose triangular flap, pointing backward.



LOGUE.

BOOPS.

Other characters as in the sparoid fishes; teeth of the outward row broad and cutting; mouth rather small.

BOGUE.

BOX. OXEYE.

Boöps, Böx, Boëz,	Jonston; Table 20, f. 8.
Boöps primus,	Willoughby; p. 317, tab. v. 8.
Sparus boöps,	Linnæus.
Boöps or Box vulgaris,	Cuvier.
" " "	Yarrell; Br. Fishes, 2nd. Sup.
Le Spare Bague,	Lacepede.
Bogue,	Risso.

In some parts of the European side of the Mediterranean the Bogue is a common fish, and where it frequents it is in great abundance. Outside the Straits of Gibraltar also, it is found far to the south, so that it is known in the Canary Islands, and even, perhaps, in the West Indies. But it is not commonly found to wander northward; and therefore it is not a fish that we should expect to visit our coasts, for the influences which point its course in that direction, across such a depth of water, however powerful, appear to be exceedingly obscure.

The first British example we have a record of was caught in a ground-sean, in company with Grey Mullets, in the early part of October, 1842, at St. Mawes, in the harbour of Falmouth, and fortunately came into the hands of Alfred Fox, Esq., who caused a drawing to be taken, from which our

figure is derived. The specimen itself was afterwards preserved, and is now in the Museum of the Royal Cornwall Institution at Truro. Since that time several examples have been caught at the same place, and one of them was presented to the British Museum by W. P. Cocks, Esq.

The general habits of this fish bear some resemblance to the others of this family, and especially in its food, which is partly animal—of such small creatures as fall in its way. But it also feeds on sea vegetables, and is consequently found to keep chiefly in places where they most abound. Its teeth, the form of which we copy from Cuvier, are well fitted to crop these weeds from the rocks; and its intestines are long, convoluted, and capacious, as is the case with all creatures, as well of the land as water, which are in the habit of making vegetables a considerable portion of their food.

It is said to be an agreeable diet, and hence, we are told, it meets with a ready sale.

The Bogue grows to the length of eight or nine inches. Jonston says it reaches to a foot, but Willoughby remarks that he never met with one of so great a length; and yet the example from which our figure and description are taken, measured in extreme length the dimensions assigned to it by the first-named writer. The general form is thick and solid; the head small proportionably to the bulk of the body, and the gape narrow. The teeth are wide, thin, and cutting, of the shape seen in the figure. The greatest depth of the specimen described was closely behind the termination of the pectoral fin, where it measured two inches and seven eighths, and from thence it tapers to the origin of the tail. The eye is larger than in others of its family; cheeks and body with large scales; lateral line high and straight. The dorsal fin is highest at its beginning, and from thence it grows narrow in its progress, as does also the anal fin; the pectorals rather narrow. The colour along the back, from the snout to the tail, is a bluish purple, mottled along the top of the head, and with tints of pink and vermilion about the eyes. By authors who have studied this fish in its more native haunts, the stripes along the sides are described as of a brilliant gold-colour, separated by stripes of bright silver; the belly silvery. But in the Cornish example the yellow on the sides

is faint, and the brilliant whiteness is changed to dull. The dorsal and anal fins are of a faint blue, as is the tail, with tints of pink.

The fin rays are enumerated by Willoughby—dorsal fifteen, anal nineteen; by Risso—dorsal fourteen to sixteen, anal three to sixteen, ventral one to five, pectoral fourteen, caudal seventeen; by us—dorsal fourteen, anal three.

Teeth of Bogue.

PAGRUS.

Two rows of small rounded molar teeth in each jaw; the front teeth fine and crowded; strong conical teeth in the outer series.

BECKER.

This is one of the fishes of which Dr. Gunther, in his "Catalogue of the Fishes of the British Museum," has expressed his opinion that Mr. Yarrell, in his history of our native species, has made the mistake of uniting the figure of one—the true Pagrus—copied from Cuvier's work, with the description and synonymes of a different species.

Where fishes so nearly resemble each other as a large portion of this family are known to do, the marks of distinction, which are laid down by description only, as also figures taken from examples perhaps badly preserved, and when their distinguishing tints have faded, are very likely to lead to errors of reference, similar to those which, in this instance and a few others, are attributed to my deceased friend. But if in this instance such an error has been fallen into, it has extended far more widely than Dr. Gunther appears to suppose, since it is shared by most of the British naturalists, if not indeed by all, and not excluding the names of those excellent observers Willoughby and Ray. These last-named authors, who acted together, had travelled along the shores of the Mediterranean, for the special purpose of studying the natural history of the fishes of that sea in connection with those of their native country; and as some misunderstanding appears then to have existed in regard to the two fishes which had fallen within their observation, they have drawn at considerable length a comparison between them. The first is the *Erythrinus* or *Rubellio*, which Dr. Gunther believes to be the same with

the fish said to be mistaken by Mr. Yarrell for the true *Pagrus* of the older and continental authors. The above-named distinguished British naturalists inform us that the *Pagrus* they are describing is the same that was known by the name of *Pagrus* to Rondeletius, Belon, Aldrovandus, and Gesner, and that it was known in England as (at least a species of) Sea Bream.

The figure they give, Tab. v. 1, f. 5, is certainly different from that of the fish familiarly known to us as the Becker; and indeed if I felt myself compelled to resort to some already published likeness for a representation of the species known to our fishermen by the name of Becker, it would not be this, but rather to the original of Mr. Yarrell's figure, at least in its outline, to which I would assign the preference. The distinctions drawn by Willoughby and his friend between the species he knew as *Erythrinus*, and that which he denominates the *Pagrus*, besides the wide difference of form, is, among others, that the *Pagrus* so much exceeds it in size as to attain the weight of ten pounds, while that of the *Erythrinus* rarely amounts to a pound and a half. Willoughby is particular in mentioning the sinus or gathering up, which is so conspicuous at the end of the dorsal and anal fins, in his *Pagrus* and our *Becker;* but he unfortunately adds that there is a strongly-marked iron-coloured spot on the side, at the origin of the lateral line, which does not exist either in our Becker or the two species he names, as represented in his figures, and which, in our British Sea Breams, is only seen in *Pagellus centrodontus* and *P. curtus*, if the latter should prove to be a separate species.

Amidst so much apparent doubt and confusion it therefore becomes necessary that no further mingling of synonymes should take place; and hence, as regards the present species and one or two more that will follow, my intention is to confine myself to such a representation, both of resemblance and description, as shall present a satisfactory account of the species as it is found with us, without mingling it with the authority of British, and still less with that of foreign writers.

The Becker is common on the south and west of England, but it does not appear to be of frequent occurrence in the north of England or Scotland. It probably will be found in

Ireland also, but it is not mentioned in Thompson's natural history of that country. Its habits are migratory, and its visits are confined to the summer and autumn, leaving us on the approach of colder weather in the beginning of winter. It is a solitary fish, so that it is not usual to find more than one or two at once in a boat, and those only of the full growth: for it has never been our chance to obtain an individual in the earlier stage of its growth. Its residence is at the depth of several fathoms, where its food is like that of the other Sea Breams. The mussel appears to be a favourite bait, but the smaller fishes, crustacean animals, and sea vegetables are eagerly devoured.

This fish is found from fourteen to sixteen inches in length, and a usual weight is five or six pounds. The head and body compressed, sloping from the origin of the dorsal fin to the mouth; lips fleshy; jaws about equal; eyes rather small, lateral; nostrils near the eye, large, and open; scales on the body and gill-covers large. The body deep, narrower towards the tail. Dorsal fin, and also the anal, expanded towards their termination; their posterior rays bound down, without much freedom of motion, and the skin at the sides is gathered up, so as to leave a considerable chink below. Lateral line rising in a gentle sweep, depressed near the termination of the dorsal and anal fins. Tail concave, pectorals pointed, ventrals large. Colour of the back bright red, with a tint of pink, and sometimes of green before the dorsal fin. The red paler towards the tail; fins generally red, except the ventrals and anal, which are dusky. Iris yellow or red, sometimes with tints of green.

Fin rays — dorsal nine, anal three.

COUCH'S SEA BREAM.

COUCH'S SEA BREAM.

Couch's Sea Bream,	Zoologist, vol. i, p. 81, 1843.
Pagrus orphus,	Cuvier.
" "	Gunther; Cat. Br. M., vol. i, p. 467.
Pagellus Rondeletii,	Zoologist, 1846.
" "	Yarrell; Br. Fishes, 2nd. Sup., p. 4.

There appears to be only one recorded instance of the capture of this remarkable species in this country, and in many respects it appears to be scarcely known to naturalists in general, although described by Cuvier as a native of the Mediterranean. The figure given by the last-named author, although referred to above, at least in the outline of its physiognomy, is but little characteristic; and the likeness of the *Chrysophrys crassirostris* would better answer to the fish we are about to describe. It was taken on the 8th. of November, 1842, with a baited hook, at a rocky ledge termed the Edges, at the distance of three miles south of Polperro, in Cornwall, and was placed in my possession as soon as it was brought on shore.

Its weight was six pounds. The head thick, the muzzle remarkably so, and rounded; the line of the front sloping suddenly from the forehead to the mouth; eyes of moderate size, high, and near the front; nostrils in a slight depression, the superior large and open. Jaws equal, not protruding, the lower with a well-marked chin. The teeth in front stout, somewhat separate, those of the upper and lower jaws interlocking. The scales large, and conspicuous on the hinder gill-covers; on the middle plate none, and slightly marked on the anterior plate. The head being short the back rises high above it. Lateral line very dark, not greatly curved, and scarcely continued to the tail, the body ending in a defined form at the origin of the caudal fin, with an incision opposite

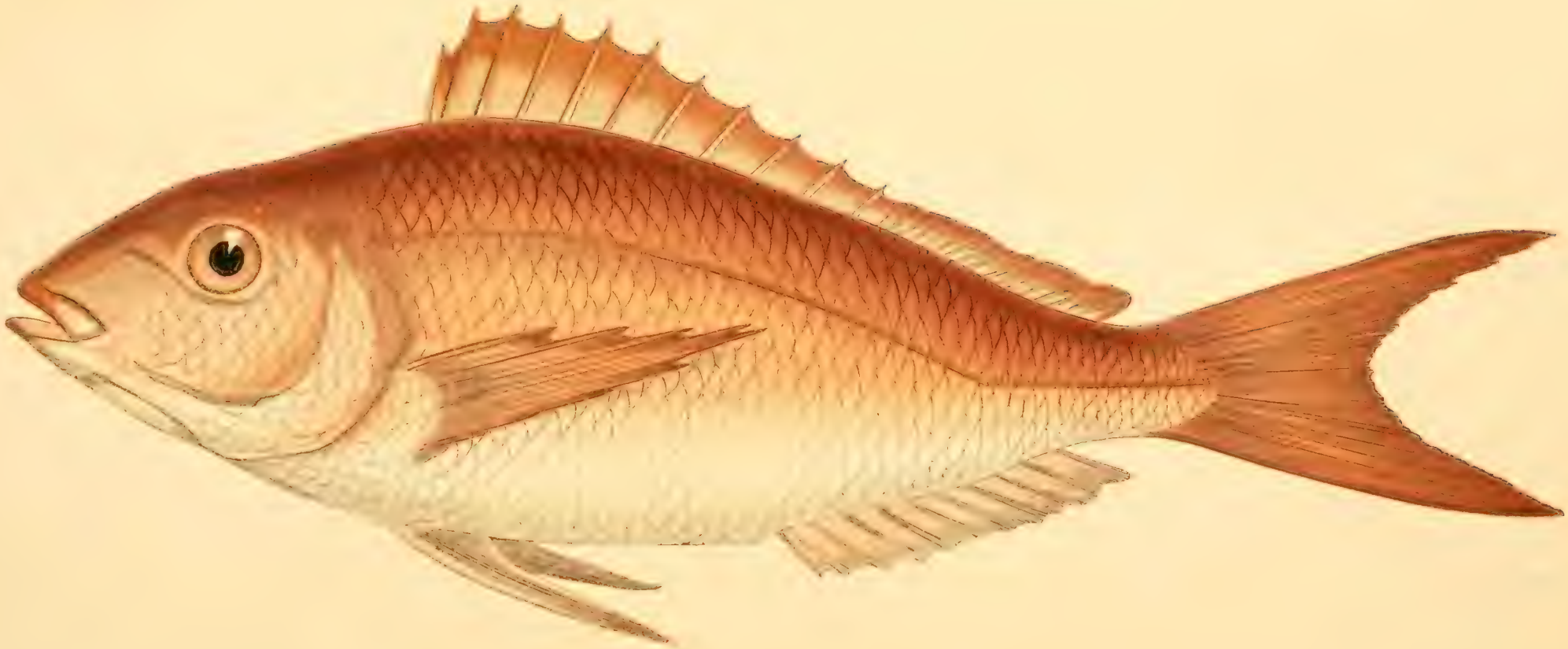
the course of the lateral line. At the vent the body appeared as if constricted. Colour of the front and top of the head brownish red; of the back and fins as if formed by a mixture of lake and vermilion; the fins of the same colour, except the anal, which is pale yellow; sides pale red; belly whitish. Iris of the eye yellow. As the colours faded there appeared a yellow margin at the angles where the scales met. There was a gathering up at the termination of the dorsal and anal fins, as in the Becker, but less conspicuous, and more decidedly at the anal than the dorsal fin. The tail concave, but less regularly so than in most of the sparoid fishes. Third ray of the pectoral fin the longest.

Fin rays—dorsal twelve firm and ten soft, pectoral thirteen, ventral four, anal three firm and eight soft.

The remarkable shortness of the head, with the roundness and steepness in the declivity of the front, equality of the jaws, stoutness and interlocking of the teeth, and singular form of the chin, are sufficient to distinguish this species from every other recognised as British; and at the same time it so nearly agrees with the figure and description of Orphe, as given by Rondeletius, that I have little hesitation in believing it to be the same fish. The only difference I can find is, that he represents the vent as being very small; which is the contrary to what was perceptible in my example; but a variety of circumstances will explain this slight discrepancy.

Among ancient writers there appears to be much disagreement regarding this fish, but the difference of their accounts will be explained when we call to mind that with them several very different species bore the same name, and even that one so denominated—the Rud—is a fish of the fresh-water. Oppian appears to represent it as devouring shell-fish, which is not improbable when we take into account the form and solid structure of its grinding teeth; but he further states what would be highly remarkable, if true:—

> ——slow-dying Orfs,
> Whose bodies long will stubborn life retain.
> Repeated wounds the tortured wretches feel,
> Yet dare the cruel hand and cutting steel;
> The parts disjoined and mangled as they lie,
> Still pant and move, and will at leisure die.



PAGELLUS.

Sea Breams with the molar teeth small, in two rows; the front teeth slender, numerous, the outward series slightly the largest.

ERYTHRINUS.

Erythrinus or Rubellio,	Jonston; p. 67, tab. 18, f. 6.
" "	Willoughby; p. 311, tab. v. 6.
Pagellus Erythrinus,	Cuvier. Gunther; Catalogue of Br. Museum, vol. i, p. 473.

This fish is well known in the Mediterranean, and its range extends so high as the mouth of the Danube. It is also not uncommon to the southward as far as Teneriffe; but its course to the north is less extensive, although it has been taken, not only in Cornwall and Devon, but in the Firth of Forth.

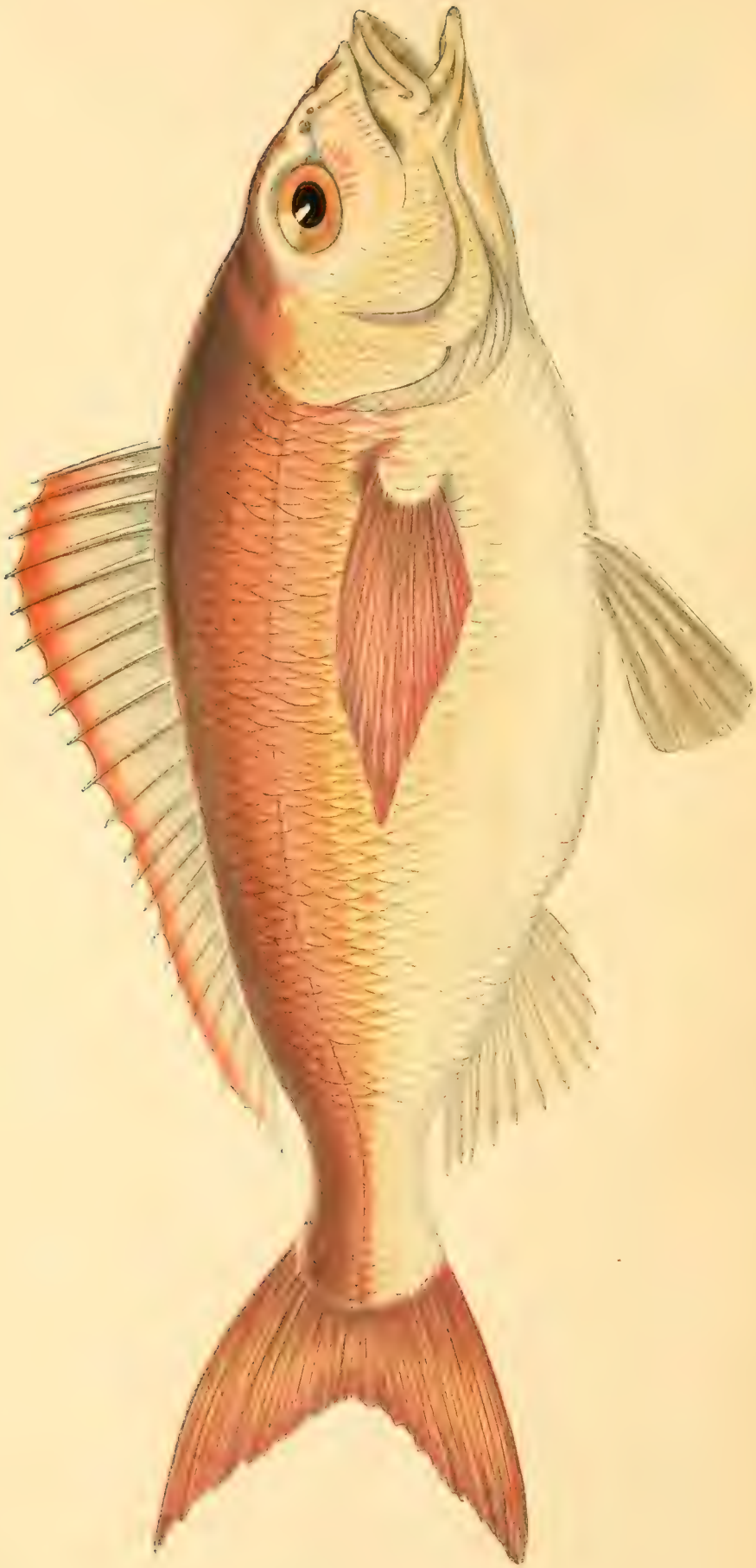
In its more native seas it is in the habit, like most others of this family, of changing its haunts according to the season; in winter keeping in deeper water, but in summer drawing near the shore, where from the regard in which its flesh is held it becomes an object of interest. Willoughby thought it most excellent in winter; which at least implies that it is caught at that season.

It may be readily distinguished from our Becker, or from the true Pagrus, with which it has been confounded; and also from the Common Sea Bream, and the Spanish Bream. From the former it differs in its smaller and more lengthened form and sharper snout; in which particulars it also differs from the two last-named species; as well as from the adult growth of the Common Sea Bream in the absence of the conspicuous spot on the side. In the individual I have examined the colour also varied remarkably from all the species of this family I have seen; but this is less to be insisted on since Risso repre-

sents it differently from our description. That author says it is pale red on the back, and light coloured below; but the colour as marked by myself was a darker, or brick red, and only varied by being paler on the belly.

The extreme length was thirteen inches, and to the end of the middle rays of the tail eleven inches and a half. The gape rather small; under jaw slightly longer than the upper. Eye of moderate size. Posterior border of the gill-cover slightly concave at its upper portion. The dorsal fin somewhat elevated at its origin; the first ray lower than the second; this fin lowest at the termination of the spinous rays. Pectoral slender, the fifth ray the longest, reaching opposite the beginning of the anal fin. Ventral long. Lateral line slightly curved, and suddenly bent down as it approaches the tail. The caudal fin more than usually concave.

Fin rays—dorsal twelve spinous and ten soft, pectoral fifteen, ventral one spinous and five soft, anal three spinous and ten soft, caudal eighteen, besides obsolete rays.



SPANISH BREAM.

Axillary Bream, YARRELL: Br. Fishes, vol. i., p. 122.
Pagellus Owenii, GUNTHER'S Catalogue of the Br. Museum, vol. i., p. 478.

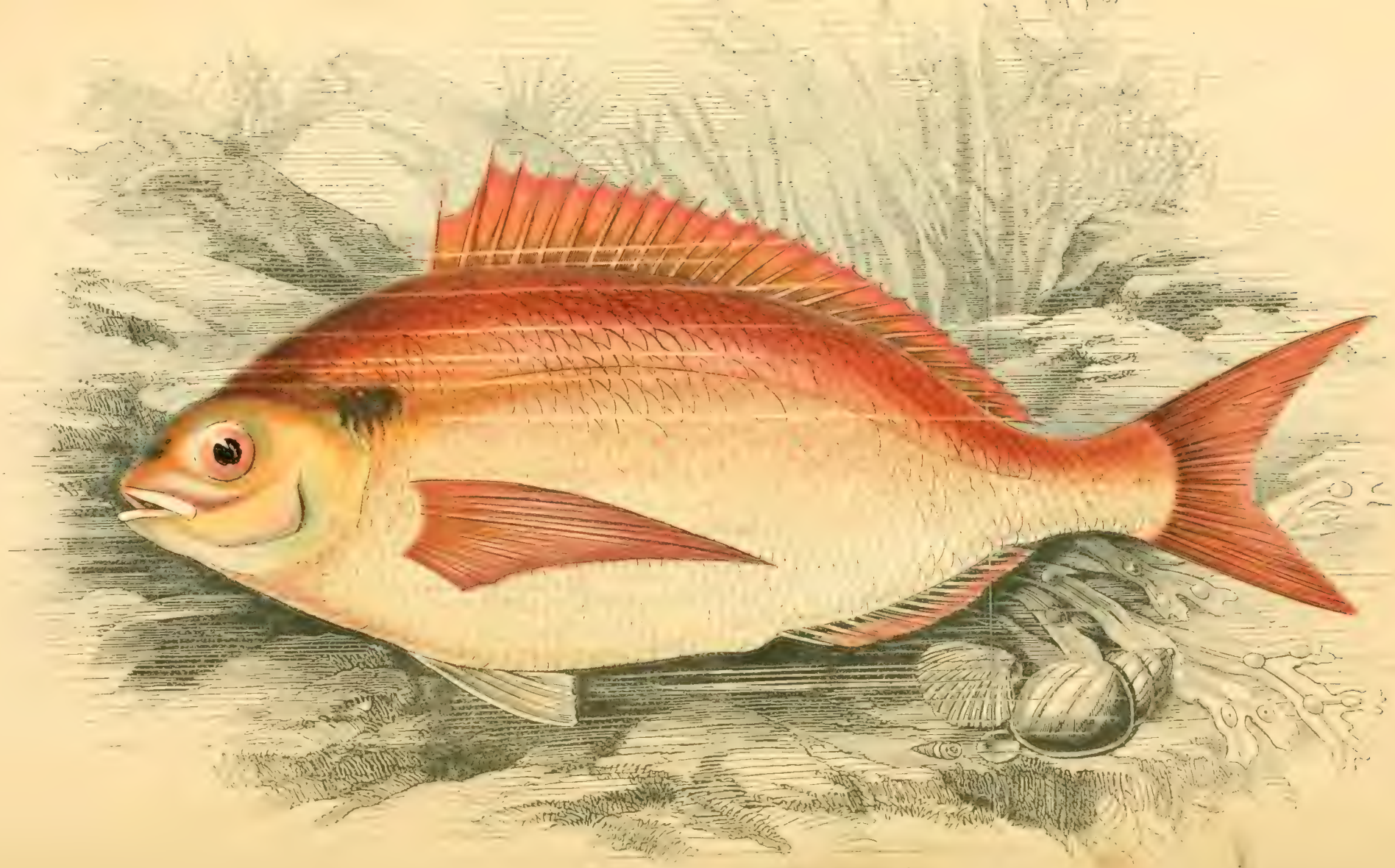
THIS is one of the fishes on the synonymes of which doubt is thrown by Dr. Gunther, as quoted above; and on which therefore, in conformity with a rule already laid down, we must be contented to make our remarks without reference to other authors; but it is the best known to Cornish fishermen of all the species of Sea Breams that wander to our shores only on unusual occasions; and with them it bears the name of Spanish Bream; that name not being applied, as Mr. Yarrell seems to have understood, to the *Erythrinus*, which was the subject of our last article; unless indeed it may have so happened by their confounding one with the other.

We only meet with single examples of this fish; which are usually caught with a common baited hook among other Sea Breams, in the summer and autumn. As, however, this fish bears some near resemblance to the fish next to be described, a close description will be best made by a comparison of one with the other.

The weight scarcely exceeds two thirds of that of the Common Bream; the body rather more slender, head flatter on the top, eye smaller and more oval. Before the eye the snout more protruded, gape wider; the grinding teeth broader and more blunt. Scarcely a depression before the eyes to receive the nasal orifices; while in the common species they are conspicuous. Dorsal fin more elevated, the anal wider. The pectoral fin reaches opposite the vent, but in the Common Bream to the third ray of the anal fin. As we only meet with it in its full

growth, the absence of the lateral spot is also a distinguishing mark.

It appears to have been taken in Scotland as well as in the south counties of England. It is not mentioned among Irish fishes by Mr. Thompson; but there can be little doubt of its visiting that country also, if closely enquired after.



COMMON SEA BREAM.

BREAN.

Sparus aurata,	Donovan; pl. 89.
Spare Marseillois,	Risso.
Pagellus centrodontus,	Cuvier. Gunther's Catalogue Br. Museum, vol. i., p. 476.
" "	Yarrell's Br. Fishes, vol. i., p. 190.
Sparus centrodontus,	Jenyns; Manual, p. 356.

In regard to this fish, which with us is the most abundant of its family, an extraordinary amount of confusion has existed; which has been produced by mistaking it for some species that had been described in a general way by foreign writers, but which are of rare occurrence in Britain; so that our native writers had not possessed the opportunity of actually comparing the one with the other. Willoughby and his friend John Ray appear to have led the way in this mistake; and being without a figure, and more intent on observing the fishes of the Mediterranean than those of Britain, they appear to have satisfied themselves with the belief that this species, which they certainly must have been acquainted with, was the same with the Gilthead, or *Sparus aurata;* which latter again they were scarcely able to distinguish from the Pagrus; and accordingly Willoughby calls his Pagrus by the English name—a Sea Bream; which Ray, in his "Synopsis Piscium," more definitely designates the Sea Bream; although the presence of the black spot on the side of the one and its absence from the others, should have been sufficient to have assured him of the difference between them.

It does not appear that Linnæus was acquainted with the present species; and Pennant, to a characteristic likeness of the

Common Sea Bream, united a description of the Gilthead, which he appears to have borrowed from some other authority. It is further remarkable that even so lately as when Dr. Turton published his "Translation of the System of Linnæus," he gave no sign by which we can conclude that he recognised our Sea Bream as a distinct species. Risso is probably correct in supposing that Lacepede refers to this fish by the name of *Sparus massiliensis;* but the remarks of the French naturalist tend to shew that he knew but little of its form or habits. It is therefore to Risso himself that we are indebted for the first distinct description of this fish as a separate species.

The Sea Bream is among our commonest, and at times most abundant fishes; and it is known from one extremity of the United Kingdom to the other. It breeds with us, and usually towards the end of the year, or in the months of winter; its station then being chosen at the depth of from thirty to forty fathoms. I have ascertained the existence of the young ones, of about an inch in length, early in January; but it seems probable that some of these fishes have not shed their spawn earlier than this season; and the young do not draw near the land until the spring has begun to yield to summer; after which, and through the autumn, they abound along the coast, and in harbours where rock and the greener sea-weeds are common, where they are angled for in the evening with much success. At this season they measure from four to six inches in length; and do not shew the dark spot on the side, which afterwards becomes a distinguishing mark of the species. In this early stage they bear the name of Chads; but towards the close of autumn the name changes as the darkened patch begins to appear. The spot, however, is not fully established until about the time of full growth; which is in the succeeding spring.

This fish so far partakes of the nature of the others of its family, as to be deeply sensible to cold; and in consequence it happens that in ordinarily severe winters it passes into deep water beyond the reach of fishermen. But it soon returns on the restoration of a milder temperature, sometimes in considerable numbers. It occasionally happens, indeed, that from influences not easily understood, they assemble in enormous multitudes; and this occurs most frequently about the close of summer, when they have been observed, contrary to their ordinary habits,

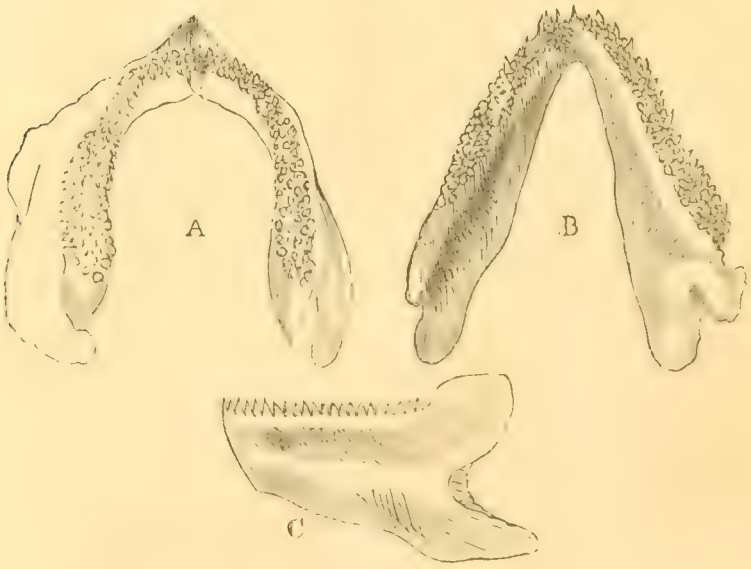
to rise to the surface and pursue their course, as if engaged in some important business of migration. Their actions under these circumstances have sometimes led the managers of Pilchard seans into considerable mistakes, from the supposition that they were a body of the latter fish; and the large abundance of them thus collected may be judged of by the fact that on one occasion, twenty thousand, and on another, as I have been informed, sixty thousand were caught in a sean at one time.

When thus assembled into what is termed a schull, the fish of a given age or stage of growth are found to keep together in one body, and instances have occurred where a schull of Chads or Bream have been enclosed together in a sean, in near assemblage with a schull of Pilchards, without intermingling with them; under which circumstances in the proceeding of the fishermen, termed tucking, which will be described when we give the Natural History of the Pilchard, it has happened that the boats have first been loaded with the last-named fishes; and when they have returned on the following day to obtain the supposed remainder of their prize, to their surprise and disappointment, they have found nothing to satisfy their hopes but to them a worthless cargo of Breams or Chads.

A story is known of an adventure of this kind, in which it would have been difficult to persuade the fishermen that some infernal agency had not been at work to disappoint their expectations, and rob them of their gain. A poor woman had gone to the sean boat to beg the gift of a few out of a successful capture of Pilchards; and usually such a request would not be preferred in vain. But on the present occasion she met a refusal, and after uttering some hasty and angry expressions, among which was a wish for their future ill-success, she went away disappointed. It happened that this poor old woman had some indefinite suspicions attached to her, as if she possessed an influence with the evil one, who would not be inattentive to her imprecations. A return to the sean, for the purpose of taking up the remainder of the capture, confirmed the worst fears of the fishermen; for, instead of the expected Pilchards, nothing offered itself but an equal loading of Chads; with the accompaniment however of a drowned toad; which was immediately pronounced to be an unquestionable proof of the witch's proceedings. Nor did the result tend to lessen this impression.

One of the angry fishermen had taken the offending toad with him on his return; and he threw it with some exclamation into the house of the supposed agent of the evil one. It was during a war with France; and presently afterwards this man with others was taken prisoner by the enemy. In an attempt to escape he fell before the balls of his guard, and he was the only one that did so.

The Bream feeds on small fishes, crustacean animals, and sea-weeds, and it takes a bait freely; but it makes only a low price in the market; and when abundant I have known it sold for two shillings and sixpence the hundredweight. This unworthy price, however, is not a criterion of its true value for the table; for it is by no means to be disregarded as food, and Risso speaks favourably of it. But soon after it is caught it loses its freshness, and therefore will not bear that slow carriage which has been usual to a distant market. The railroad will remove that difficulty, and convey a palatable food of moderate price to places at which before it was unknown.



DENTITION OF THE COMMON SEA BREAM.

A.—Upper jaw, within. B.—Under jaw, within.
C.—Outside, side view.

SHORT SEA BREAM.

LVI

SHORT SEA BREAM.

Pagellus curtus, Zoologist; vol. ii, p. 394.
" " Gunther's Catalogue Br. Museum, vol. i, p. 377.

On the 2nd. of September, 1843, a fisherman of Polperro took with one of his ordinary baits a Sea Bream, which he presently discerned never before to have fallen under his notice; and in consequence it was transferred to my possession as soon as he reached the land, which was before sufficient time had passed to allow it to undergo any change. At the first inspection I was led to suppose that this example was nothing more than a deformed specimen of the Common Sea Bream; and such perhaps will be the opinion of some naturalists, until at least another example with similar characters is obtained, and renewed observation shall compel them to review their opinion. But for myself, on close examination, I found this example to differ in so many particulars besides its shortened form, that I was induced to believe it more probably a distinct species; nor has the objection to this opinion appeared to me a very formidable one,—that no more than a single specimen has come under the observation of naturalists; for the same remark may be made of other species of fishes undoubtedly distinct, but of which a single example only is on record. That no species nearly resembling it is described by former authors, however widely extended their observations, is only a proof of its rarity, and not of its being an abnormal formation of nature.

The length of this fish was fourteen inches, the greatest depth nine inches and a half; and in proportion to its kindred species the Common Sea Bream, it was of considerable thickness. Under jaw slightly the longest; the teeth in front and forward on the sides slight, conical, and somewhat scattered; gape moderate. Eye very large, being an inch and three fourths across; nostrils in a depression before the eyes, in this respect

and in the cheeks for the most part resembling the Common Sea Bream; but slightly differing in the markings of the head. The body thick and plump; scales on the cheeks and body large; those on the hinder part of the body, especially above the lateral line, having well-marked festooned edges; those of the anterior part less regularly so. Lateral line at first mounting, arched, sinking opposite the ending of the dorsal and anal fins, waved in its course, and mounting again as it approaches the caudal fin: at its origin a large black spot. Pectoral fin very long, reaching to within a short distance of the termination of the anal fin; being in length four inches and three fourths, and passing two inches beyond the vent. Commencement of the dorsal fin just above the origin of the rays of the pectoral. Tail concave. The colour was much as in the Common Sea Bream, but more vivid; top of the head rich brown, the back scarlet, lighter on the sides; belly white, with slight mottlings. Dorsal, pectoral, and caudal fins, and the inside of the mouth, vermilion; ventral and anal fins paler.

Compared with the Common Sea Bream, laid by its side, besides the remarkable difference of the dimensions, it was distinguished by a wider gape; by the teeth, although alike in arrangement and structure, less thickly placed, especially the incisors; by a less rounded muzzle, a much larger eye, and longer pectoral fins; which being more arched, are differently shaped. In a Common Bream of the same length these fins measured three inches and three fourths. The scales also were more decidedly waved at their edge. In the stomach I found a Comatula and the bait with which it was taken, which was a slice of fish; but in the lower intestine were pieces of brown sea-weeds covered with *Flustræ*, (encrusting corals,) still continuing undigested.

Fin rays—pectoral fifteen, dorsal twelve and twelve, ventral one and five, anal three and thirteen, caudal about twenty.

Scales of the Short Sea Bream.

GILTHEAD.

LVII

CHRYSOPHRYS.

With round molar teeth on the sides of the jaw, forming three rows in the upper; a few conical teeth in front.

GILTHEAD.

Aurata,	Jonston; Tab. 16, f. 2.
"	Willoughby; p. 307, Tab. v. 5.
Sparus aurata,	Linnæus. Fleming; Br. An., p. 211.
" "	Jenyns; Manual, p. 353.
Spare Dorade,	Lacepede. Risso.
Chrysophrys aurata,	Cuvier. Yarrell; Br. F., vol. i, p. 111.

This fish is well known in the Mediterranean, and it appears from Pliny and Columella that it was held in much esteem for the tables of ancient Rome, for the supply of which it was kept in ponds, and fed with oysters to give it a better appearance and flavour; and in Martial's opinion it was only when thus fed that it became worthy of notice:—

"Non omnis laudem pretiumque Aurata meretur;
Sed cui solus erit concha Lucrina cibus."
Xenia.

The Gilthead only shall my praise partake
When fed with shell-fish from the Lucrine lake.

And shell-fish, with crabs, were supposed to be its chief or only food in its free condition, the solid structure of its teeth being well fitted to crush them in such a way as to be fit for digestion.

The Gilthead does not often wander so far north as the British Islands, although examples have been met with in Cornwall and Devonshire, and Dr. Fleming obtained one so far north as the mouth of the River Tay, in Scotland. Mr.

Cocks, of Falmouth, has met with a couple of these fishes in the fish-market of that town, and his remarks on them were, —that one was fat, and rich in colour, the length sixteen inches and a half, the breadth six inches; the second appeared sickly, the mouth small, lips pouting and livid, the colour like tarnished silver.

This fish is said to be highly sensible of the impressions of much heat and cold, so that when these prevail it retires to deeper water; and, according to Pliny, this retreat, in the heat of summer, lasts for sixty days.

Ælian represents it as amongst the most timid of fishes; and he gives as a reason for this opinion, that they were stopped and caught at the retreat of the tide by a circle of brushes stuck upright in the sand, through which they were afraid to urge their way. This, it seems, was a mode of fishing adopted on the shores of Greece at such times as there was some recess of the tide, so that when the sea again ebbed the fish were left dry on the shore; and something similar to it is practised at this time on shelving shores even in our own country.

The relative dimensions of a British example have already been given, but sometimes it is found of a much larger size, so as even to approach to the weight of ten pounds. In its general outline it bears no distant resemblance to the Common Sea Bream, but with a little more prominence of profile. Willoughby has noticed that it is thin at the back, and Linnæus has copied this particular into his specific character. But it is particularly distinguished by its colours, of which Lacepede has afforded a glowing description. It shines, says he, with the mild lustre of silver and sky blue, the latter, which is the colour of its back, being more heightened by the silvery tints which are spread over the rest of its body; and both these colours are rendered the more conspicuous by the black of the dorsal and caudal fins, as well as by the longitudinal brown lines which pass along the sides. A golden half circle appears above the eyes, with the concavity directed backward; and a dash of black on the gill-cover and origin of the tail, form a beautiful contrast with the silver of the scales, while a third spot of a similar kind, but of lively and variegated red rests a little above the root of the pectoral fins.

These beautiful colours are described in somewhat similar, although more subdued terms, by Willoughby and Risso; but they may be expected to be far more faint when this fish comes to our coasts, if they be not then altogether changed in their aspect. There are, indeed, two species of this genus closely allied to each other, which are inhabitants of the Mediterranean, not readily to be distinguished, and both of them may, perhaps, be found to pay us an accidental visit. But, however this may be, I find it difficult, on the score of colour alone, to assign to either of them the species of which the figure is here given, but which is a correct representation of an example which fell under my own inspection speedily after it was taken from the sea. The form and arrangement of the teeth are proofs of its being a member of this genus; of which no more than the two species above referred to have been recognised in Europe.

Fin rays—dorsal eleven spinous and fourteen soft, pectoral sixteen, ventral one spinous and five soft, anal three spinous and twelve soft, caudal seventeen.

END OF VOL. I.

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